DEVELOPMENT AND VALIDATION OF THE TECHNOLOGY ADOPTION AND GRATIFICATION (TAG) MODEL IN ASSESSING LECTURERS' ICT USE

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ABSTRACT

In this age of exponential knowledge growth, where Information and Communication Technology (ICT) has been playing a dominant role, the authorities of Higher Education concerned have to ensure that the ICT facilities remain within the reach of the lecturers for their teaching and research purposes. However, despite a decade of existence, the ICT facilities were found to be underutilized by lecturers. Constructs such as computer self-efficacy, perceived ease of use, perceived usefulness, use and gratification were hypothesized to be major barriers. In doing so, the prime objective of this study was to develop and validate the Technology Adoption and Gratification (TAG) Model to assess the lecturers' adoption and gratification in using ICT facilities in higher education. The second purpose of this study was to evaluate the cross-cultural validation of the causal structure of the TAG model. The respondents were collected from two public universities, namely, University of Malaya in Malaysia and Jiaxing University in China. A total of 396 lecturers were selected using a stratified random sampling procedure. A questionnaire consisting of items validated from prior studies were put together and modified to suit the current study. A seven-point Likert scale asking the respondents of the extent of their agreement/disagreement to the items constituting the construct in the questionnaire was used. The questionnaire's validity and reliability were established through a Rasch model using Winsteps version 3.94. The sample size was judged adequate for the application of Structural Equation Modeling (SEM) to develop and validate the Technology Adoption and Gratification (TAG) Model as well as assess all the research hypotheses. The data was analyzed using AMOS version 18. The findings of the TAG model discovered that computer self-efficacy had a statistically significant direct influence on perceived usefulness and perceived ease of use. Subsequently, lecturers' perceived ease of use and perceived usefulness had also statistically significant direct influence on their gratification in using ICT facilities in higher

education. Moreover, perceived usefulness and perceived ease of use revealed significant direct influence on lecturers' intention to use ICT facilities for their teaching and research. Similarly, lecturers' intention to use had statistically significant direct effect on their gratification as well as actual use of ICT facilities, respectively. On the other hand, computer self-efficacy had a significant indirect influence on gratification mediated by perceived ease of use and perceived usefulness, respectively. Meanwhile, computer self-efficacy had also significant indirect influence on lecturers' intention to use mediated by perceived ease of use and perceived usefulness, respectively. Eventually, lecturers' perceived ease of use and perceived usefulness had statistically significant indirect influence on their gratification in using ICT facilities in higher education mediated by intention to use. The results of the invariance analysis of the TAG model demonstrated that the model was valid for measuring lecturers' adoption and gratification in using ICT facilities. However, the TAG model works differently in the cross-cultural settings. The findings contribute to the body of knowledge by developing and validating the TAG Model as proposed in this study. The results will also help the Universities' higher authority in taking and providing necessary steps towards training to the personnel regarding the application of the ICT facilities in higher education.

ABSTRAK

Dalam zaman pertumbuhan eksponen pengetahuan, di mana Teknologi Komunikasi Maklumat (ICT) dan telah memainkan peranan yang dominan, pihak berkuasa Pengajian Tinggi berkenaan perlu memastikan bahawa kemudahan ICT berada di dalam jangkauan pensyarah untuk tujuan pengajaran dan penyelidikan mereka. Walau bagaimanapun, walaupun satu dekad kewujudan, kemudahan ICT didapati kurang digunakan oleh pensyarah. Konstruk seperti komputer sendiri keberkesanan, mudah dilihat penggunaan, tanggapan kegunaan, penggunaan dan kepuasan hipotesis telah menjadi halangan utama. Dengan berbuat demikian, objektif utama kajian ini adalah untuk membangunkan dan mengesahkan Penggunaan Teknologi dan Wang Suapan (TAG) Model untuk menilai penerimaan pensyarah dan kepuasan dalam menggunakan kemudahan ICT dalam pendidikan tinggi. Tujuan kedua kajian ini adalah untuk menilai pengesahan silang budaya struktur yang menyebabkan model TAG. Responden telah dikumpulkan dari dua universiti awam, iaitu Universiti Malaya di Malaysia dan Universiti Jiaxing di China; pensyarah yang bekerja di fakulti yang berbeza. Seramai 396 pensyarah telah dipilih menggunakan persampelan berstrata prosedur rawak. Satu soal selidik yang terdiri daripada item disahkan daripada kajian sebelum telah bersama-sama dan diubah suai untuk disesuaikan dengan kajian semasa. A tujuh mata skala Likert meminta responden setakat perjanjian mereka / tidak bersetuju dengan perkara-perkara yang menjadi binaan di dalam soal selidik yang telah digunakan. Kesahan soal selidik dan kebolehpercayaan telah ditubuhkan melalui model Rasch menggunakan Winsteps versi 3.94. Saiz sampel dihakimi mencukupi untuk aplikasi pemodelan persamaan berstruktur (SEM) untuk membangunkan dan mengesahkan Penggunaan Teknologi dan Wang Suapan (TAG) Model serta menilai semua hipotesis penyelidikan. Data dianalisis menggunakan Amos versi 18. Dapatan model TAG mendapati bahawa komputer self-efficacy mempunyai pengaruh langsung yang signifikan secara statistik

pada manfaat dan tahap kemudahan dilihat penggunaan. Selepas itu, pensyarah dilihat kemudahan penggunaan dan kegunaan dilihat mempunyai pengaruh langsung juga statistik yang signifikan pada kepuasan mereka dalam menggunakan kemudahan ICT dalam pendidikan tinggi. Selain itu, manfaat dan tahap kemudahan dilihat penggunaan mendedahkan pengaruh langsung yang signifikan terhadap niat pensyarah menggunakan kemudahan ICT untuk pengajaran dan penyelidikan mereka. Begitu juga dengan niat pensyarah untuk penggunaan mempunyai kesan yang signifikan secara statistik langsung pada suapan mereka serta penggunaan sebenar kemudahan ICT, masing-masing. Sebaliknya, komputer self-efficacy mempunyai pengaruh yang ketara tidak langsung pada suapan pengantara dengan mudah dilihat penggunaan dan tanggapan kegunaan masing-masing. Sementara itu, komputer self-efficacy juga mempunyai pengaruh yang ketara tidak langsung kepada niat pensyarah untuk menggunakan pengantara dengan mudah dilihat penggunaan dan tanggapan kegunaan masing-masing. Akhirnya, pensyarah dilihat kemudahan penggunaan dan kegunaan dilihat mempunyai pengaruh langsung statistik yang signifikan pada kepuasan mereka dalam menggunakan kemudahan ICT dalam pendidikan tinggi pengantara dengan niat untuk digunakan. Keputusan analisis invariance yang model TAG menunjukkan bahawa model itu adalah sah untuk mengukur penggunaan pensyarah dan kepuasan dalam menggunakan kemudahan ICT. Walau bagaimanapun, model TAG bekerja secara berbeza dalam tetapan silang budaya. Penemuan menyumbang kepada badan pengetahuan dengan mengembangkan dan mengesahkan Model TAG seperti yang dicadangkan dalam kajian ini. Keputusan juga akan membantu pihak berkuasa Universiti 'yang lebih tinggi dalam mengambil dan menyediakan langkah-langkah yang perlu ke arah latihan kepada kakitangan mengenai permohonan daripada kemudahan ICT dalam pendidikan tinggi.

DEDICATION

This research is dedicated to my parents, A.Y.M. Nazrul Islam and Noor Aptap Pear Zahan Chowdhury, as well as my wife, Qian Xiuxiu, for their encouragement, sacrifice, endeavor and ideas when I was conducting this research. Moreover, this work is also devoted to human beings as my contribution to the development of human capital which is of utmost significance in Islam.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Information and Communication Technology (ICT) constitutes a key dimension in the process of the wider development of a country. The estimation of the ICT evolution involves use of an appropriate metric for assessing the information society in a country on the sub-indices of access, use and skills (Kyriakidou, Michalakelis & Sphicopoulos, 2013). Their study of the influential components of the ICT maturity level revealed considerable discrepancies in their influence in developed and developing countries. The use factor was found to be considerably more important in developed countries than in developing countries. Notwithstanding the fact that, during previous years ICT witnessed an escalating dissemination. The distinctions in the level of use, access and skills of ICT can be identified both within and between countries. The policy and decision makers have stated that these dissimilarities cause an ICT gap and thus strategies aiming at the expansion of ICT have been applied in many countries. Hence, assessing and analyzing the digital split among countries is of overriding consequence for researchers as well as managers.

As information and communication technology (ICT) is increasingly used in education, its integration to teaching, learning and research have had immense significance in fostering technology-based education among university lecturers, students and staff. Hong and Songan (2011) contend that in Southeast Asia, ICT is being utilized more to deal with the challenges that are faced by higher education systems. In this regard, they have discussed a series of likely applications of ICT. For instance, what and how students learn, when and where students learn, how new

students and lecturers interact, and how to reduce the cost of education. However, there is very little research on effective utilization of ICT in tertiary education programs in Southeast Asia. Thus, it is immensely significant for related and advanced staff of higher education to learn from success stories, experiences and lessons from the application of ICT in countries within the region. Among those, particular stress should be laid on the various practical and research-based experiences with respect to teaching and learning, which include e-learning and blended learning, pedagogic innovation in using ICT for increased usefulness, accessibility and efficiency of higher education, applying ICT for online approaches for professional improvement in higher education, and implementing ICT projects in higher education to enhance access and quality of learning. Furthermore, they affirmed that the higher education systems need to keep up with the rapid progress in knowledge and skills that followed the introduction of new advanced technologies rather than the requirements on relevancy of employees. Moreover, to be competitive in the gradually challenging global economy circumstance, it is very essential for university students in this region to be armed with the appropriate knowledge, skills and aptitudes.

Malaysia is a developing country that is progressing towards development. It follows the models implemented and practiced in developed countries to maintain right and steady pace towards development. Malaysia extracts its ideology for the development process, especially for the education sector, from developed countries such as Australia, where about 80% of academics use technology in regular ways as part of the teaching and learning program (Oliver and Towers, 2000). In Malaysia, the implementation of technology in teaching and learning activity has attracted great interest from the practitioners in higher education institutions (HEIs), which have started to adopt and implement information and communication technology (ICT)

solutions as a source of a flexible teaching and learning process (Azizan, 2010).

With rapid expansion of information technology, information access is expected to become central to life in the 21st century (Huang, Liu, Chang, Sung, Huang, Chen, Shen, Huang, Liao, Hu, Luo, & Chang, 2010). The incorporation of information and communication technology into classroom practices can integrate a wide range of activities. From those designed to inspire learners to devour knowledge (e.g. teachers' use of presentation software, DVDs or podcasting) to those designed to increase students' capabilities to generate their own knowledge (e.g. development of a reflective blog, collaborative wiki site or e-portfolio). Thus, ICT offers the prospect of improving both teaching and learning and it is for the educator to decide when and how it can be applied. Nevertheless, there is extensive agreement in the literature demonstrating that teachers are not willing to acquire complete benefit of these opportunities (Groff & Mouza, 2008; Sutherland, Robertson & John, 2009; Levin & Wadmany, 2008).

In a study, Bate (2010) evaluated how new teachers applied ICT in the first three years of their teaching and understood the role that ICT played in developing pedagogical practices of the educators engaged. The findings demonstrated that fresh teachers expressed pedagogical beliefs that entail their learners in dynamic meaning making. These teachers were capable of using a basic suite of ICT software. Nevertheless, pedagogical beliefs that resonate with modern learning theory and operational ICT capability did not translate into practices that synergised pedagogical content and technological knowledge. Moreover, educators did not use ICT in ways that are consistent with their affirmed pedagogical beliefs. Liu (2012) asserted that pre-service teachers must be prepared with the aptitude to assimilate technology to facilitate their prospective students' learning. Furthermore, Liu (2012) concluded that

teacher education courses did not facilitate teachers' use of technology when teaching students in practicum environments.

According to Blackwell, Lauricella, Wartella, Robb and Schomburg (2013), the enhanced access to technology with sustained under-utilization in education necessitates comprehending the obstacles faced by teachers in incorporating technology into their classrooms. It is remarkable that many models assume that educators have a moderate R^2 value when using technology and anticipate a reasonable proportion of the variance in how frequently teachers use a certain technology. Their findings showed that models for the teachers' use of computers, iPod touch devices, and tablet computers accounted for around 27–35% of the variance. The inclusion of attitudes and beliefs constructs as additional dimensions altered these models from insignificant to significant and enhanced the assumption of teachers' actual use of technology. They also suggested that the reliability and significance of the affordances and obstacles scales discovered in their study makes their application practical in future quantitative studies of teachers' use of technology.

Zhou, Zhang and Li (2011) stated that over the last two decades, the incorporation of ICT into teaching and learning has become an indispensable topic in education. Studies have revealed that ICT can improve teaching and learning outcomes. As such, they investigated how well secondary pre-service teachers were equipped to use technology for teaching in China and evaluated teachers' experiences with views of and anticipations about the use of technology. Their findings showed an overall low level of capability to use technology and few mutual concerns shared by technology training teachers observed in the teacher education programs. The results also discovered that universities fall behind in terms of ICT facilities. More than forty percent of teachers desired the university to update its hardware, and over fifty percent

recommended that the university expand its quantity of computers and labs. Over half of the respondents wished the software were updated and roughly seventy-six percent demanded a higher-speed campus network. The insufficient access to technology was also demonstrated by the disappointments voiced by teachers having restricted access to the computer labs.

According to Soffer, Nachmias and Ram (2010), in the recent decade, the information technologies have penetrated each field of our daily life, including education. The incorporation of instructional technology is no longer an extravagance in higher education but a necessity for all universities. The main contribution of this study is highlighting the necessity of acquiring better comprehension of the procedures of the diffusion of web-based learning among lecturers in higher education and the reasons that influence adoption rate.

Lai (2011) asserted that the use of digital technologies might assist a shift of cultural practices in teaching and learning, to serve the needs of the 21st century higher education learners. As a result, higher education institutions require improved efficiency, additional transparent accountability and better performance in both teaching and research. However, from the studies that have been undertaken to assess the overall impact of ICT on teaching and learning in higher education in the last two decades, one can conclude that higher education institutions have been slow in acquiring the complete benefit of the prospective advantages offered by the use of ICT. In this regards, several obstacles have been identified, as to why such a little impact has been made on the use of ICT in teaching and learning in higher education. The lack of understanding of why and how technology should be included in pedagogy by university educators has been recognized as the key cause, and the lack of professional expansion opportunities is typically quoted as the reason for this lack of understanding.

According to Lau and Yuen (2013), social revolution is inevitable with the emergence of ICT. Further, technology also leads to numerous momentous alterations in a number of school practices; and in this process, teachers are the main players in the introduction and continuity of those changes in daily classroom practices. Thus, in order to assist their use of technology in teaching, educational technology training becomes indispensable. However, this leads to another paramount problem of identifying the factors that influence technology adoption and the formulation of workable solutions to sustainably integrate technology into teaching practices. In fact, teachers' perception towards technology is a significant element that affects the decision on technology adoption despite that training was found to influence perceptions, especially in terms of teachers' self-efficacy, attitudes and beliefs. Furthermore, the actual gap between research and practice hedges the application of educational research in daily routines which causes criticism. Although a lot of effort has been put into identifying both contributing and inhibiting factors of technology use, teachers are still reluctant and opposed to adopting technology in their classrooms. Nevertheless, teachers are the most important factor in the series of educational changes. And, teachers' professional development is the most valuable solution to stimulate their technological adoption. Moreover, they claimed that effective integration of technology in education is a complex and multi-faceted issue. They conducted their study among in-service mathematics teachers and identified a variety of technology adoption parameters. Meanwhile, their study demonstrated that senior teachers' attitudes towards educational benefits of utilizing technology are not consistent with their perceived efficacy. Thus, it not only reveals that improvement on educational technology training for in-service teachers is needed, but also there is a gap between practice and research in educational research which is a serious issue.

Despite the benefits that increased technological options can provide, there are still many barriers to the successful integration and usage of emerging educational technology such as Internet within educational environments (Roblyer, 2006; Wozney, Venkatesh & Abrami, 2006). According to Zejno and Islam (2012), determinants such as perceived ease of use, benefits, and ability to use the ICT facilities were assumed to be major barriers by postgraduate students in higher education. Islam (2011a) claimed that one of the ICT facilities, namely, the research database was discovered to be underutilized, especially by postgraduate students. Factors such as perceived benefits, computer self-efficacy and satisfaction were hypothesized to be major barriers. Despite a decade of existence, literatures have demonstrated that the majority of studies were concerned with the development of integration of information and communication technology (ICT) in teaching and learning and the acceptance or adoption of the use of ICT applications from the perspective of preschool teachers and students. Little research has been conducted on discovering lecturers' adoption and gratification in using ICT facilities for research and teaching in higher education. Moreover, in its endeavor to foster the use of technology in higher education, the University of Malaya (UM) in Malaysia and Jiaxing University (JU) in China provide extensive ICT facilities to cater to the needs of the lecturers. However, since its execution, no research has been conducted to assess the lecturers' adoption and gratification of using this emerging educational technology within their environments for teaching, learning and research purposes. Therefore, there exists a gap for further investigation.

1.2 CONCEPTUAL MODEL

Extant literatures that examined relationships among variables related to technology acceptance model abound extensively (Kaba & Osei-Bryson, 2013; Kreijns, Vermeulen, Kirschner, Buuren and Acker, 2013; Moses, Wong, Bakar and Rosnaini, 2013; Islam, 2011a; Zejno & Islam, 2012; Saleh, 2009; Usluel, Askar & Bas, 2008; Ferdousi, 2009; Shroff, Deneen & Ng, 2011; Shittu, Basha, Rahman & Ahmad, 2011; Gibson, Harris & Colaric, 2008; Yuen & Ma, 2008; Martínez-Torres, Marín, García, Vázquez, Oliva & Torres, 2008; Lee, Hsieh & Hsu, 2011; Teo & van Schalk, 2009; Teo, 2009; Liu, Liao & Pratt, 2009; Agarwal & Prasad, 1998; Dillon & Morris, 1996; Taylor & Todd, 1995). As such, numerous theoretical models have been propounded to provide detailed explanations on users' intention to use technology, and actual technology use (Venkatesh, Morris, Davis, & Davis, 2003). Following the introduction of the Technology Acceptance Model (TAM) by Davis (1989), the model has been widely used to explain computer-usage behavior and factors associated with acceptance of technology.

According to the model, the technology adoption is influenced by the user's intention to use which consequently determined his or her attitudes towards technology. Perhaps, user's perceptions— perceived ease of use (PEU) and perceived usefulness (PU) determine the variability in these attitudinal and behavioural dimensions (Ahmad, Basha, Marzuki, Hisham and Sahari, 2010). While PEU reveals the degree to which technology might be free of efforts in its application, PU on the other hand indicates the extent to which technology usage can help in improving users' performance in order to enhance one's task (Davis, Bagozzi, & Warshaw, 1989). The suggested Technology Acceptance Model (TAM) indicates that, behavioral intention mediates the influence of the two extrinsic motivation

components, namely; PEU and PU as presented in Figure 1.1.

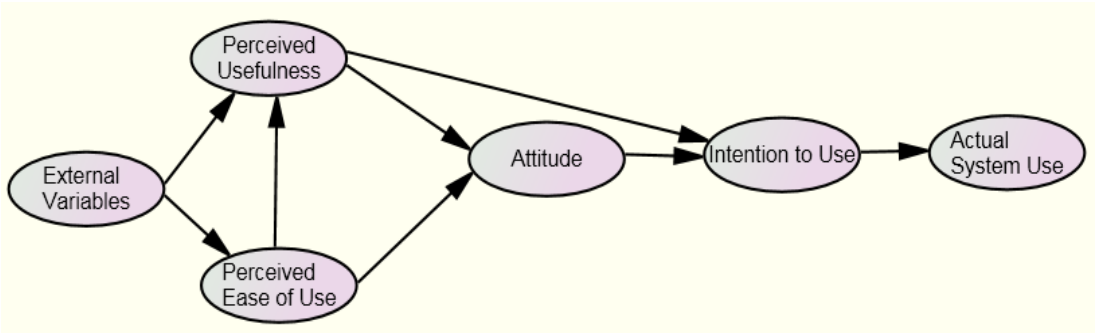

Figure 1.1: Technology Acceptance Model (Davis et al., 1989)

According to Ahmad et al. (2010), TAM has attracted the interest of decision makers, researchers and practitioners due to the fact that, it is simple, robust and reasonable. Though, it has unanimously gained empirical support in terms of its strength through applications and validations in assuming the use of information systems (Davis, 1993; Taylor & Todd, 1995; Venkatesh & Morris, 2000), current meta-analyses demonstrates that, if various overriding issues are considered, it could be resolved through proper understanding (Ma & Liu, 2004; Schepers & Wetzels, 2007; Yousafzai, Foxall and Pallister, 2007).

The Online Database Adoption and Satisfaction Model, proposed by Islam (2011a) is developed and validated by incorporating two intrinsic motivation attributes, namely, computer self-efficacy and satisfaction into the original TAM. The findings of the model affirm a better understanding of the TAM (p. 50). Additional studies on factors related to technology acceptance and refinement of acceptance models that can facilitate its generalizability has been suggested (Sun & Zhang, 2006; Thompson, Compeau, & Higgins, 2006). Considering the evolving of new technologies, perceived ease of use and perceived usefulness are not the only suitable constructs that determine technology acceptance (Thompson et al., 2006). Many researchers have shown that, including more dimensions with other IT acceptance models in order to

enhance its specificity and explanatory utility would perform better for a particular context and focus (Agarwal & Prasad, 1998; Mathieson, 1991). Moreover, there is a suggestion by previous researchers (Legris, Ingham & Collerette, 2003) that, TAM deserves to be extended by integrating additional factors that could facilitate the explanation of more than 40 percent of technology acceptance and usage. Against this backdrop, the proposed conceptual model was analyzed to develop and validate the Technology Adoption and Gratification (TAG) model of ICT usage as shown in Figure 1.2, two other intrinsic motivation attributes – gratification and self-efficacy – were incorporated into the original TAM based on prior studies (Islam, 2011b & 2011b; Islam, 2014; Wu, Chang & Guo, 2008; Ahmad et al., 2010; Huang, 2008; Shamdasani, Mukherjee & Malhotra, 2008).

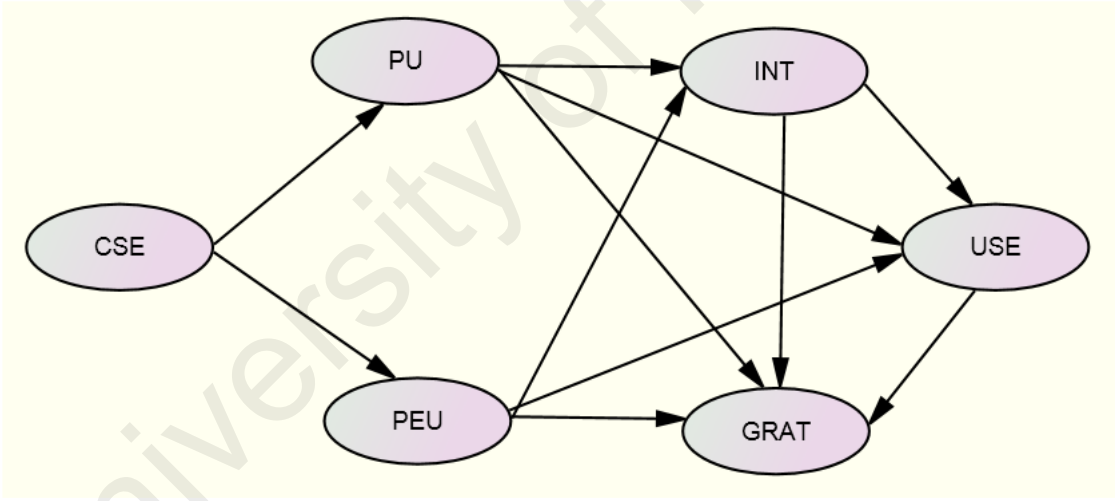

Figure 1.2: Conceptual Model

Note: PEU= "perceived ease of use", PU= "perceived usefulness", CSE= "computer self-efficacy", INT= "Intention to Use", USE= "ICT Usage", GRAT= "Gratification".

1.3 STATEMENT OF THE PROBLEM

Several studies have been and are being conducted on TAM in the attempt to measure the usage of Information and Communication Technology (ICT) among teachers and students (Islam, 2011b; Zejno & Islam, 2012; Saleh, 2009; Wozney et al., 2006; Usluel et al., 2008; Ferdousi, 2009; Kaba & Osei-Bryson, 2013; Kreijns et al., 2013; Moses et al., 2013). However, despite a decade of existence, the usage of ICT was found to be underutilized, especially by postgraduate students (Islam, Ahmad, Madziah & Sahari, 2011; Islam, Leng & Singh, 2015; Islam, 2011a). Besides this, Goktas, Gedik and Baydas (2013) discovered that the major obstacles that primary school teachers confronted in the assimilation of ICT as of 2011 emerged to be the lack of hardware and appropriate software materials, restrictions of hardware, lack of in-service training and technical support. Kim, Choi, Han and So (2012) asserted that the appearance and adoption of cutting-edge technologies generate demands for developing roles and competencies of teachers in the new knowledge society. However, it is ambiguous how well teachers have been prepared to face the challenges and difficulties of teaching and learning in the 21st century; and what directions must be acquired to better practice the new generation of teachers. In reality, the issue of human use and acceptance of innovative technologies is much more difficult and demanding (Spector, 2013). Moreover, the effective combination of ICT into education is still occasionally complex and challenging (Zhao, Paugh, Sheldon, & Byers, 2002; Keengwe, Onchwari, & Wachira, 2008).

According to Bringula and Basa (2011), even though teachers were skilled in executing diverse computer and Internet-associated activities, have a high sense of dedication to the use of the faculty web portal, and have internet access at home. The faculty web portal which comprised all online research materials, namely, Electronic

Journals, Books, Articles and Case Studies were still not used frequently. Buabeng-Andoh (2012) stated that the worldwide investment in ICT to enhance teaching and learning in schools have been instigated by many governments. Despite all these investments on ICT infrastructure, equipments and professional development to extend education in many countries, ICT adoption and incorporation in teaching and learning have been limited. If educators do not utilize technology the way it was planned to serve, the affordances of technology cannot be maximised for effectual teaching and learning to take place. As such, numerous studies on technology acceptance have been conducted over the years. Literature revealed that several acceptance studies had focused on the exploration of factors that affected technology acceptance among teachers and students (Teo, 2011). However, most studies have been conducted to assess the students (Stone & Baker-Eveleth, 2013; Alenezi, Karim & Veloo, 2010; Martínez-Torres et al., 2008; Shroff et al., 2011; Shipps & Phillips, 2013; Terzis, Moridis, Economides & Rebolledo-Mendez, 2013; Chang & Tung, 2008; Guo & Stevens, 2011; Zejno & Islam, 2012; Islam, 2011a; Rasimah, Ahmad & Zaman, 2011) and teachers (Al-Ruz & Khasawneh, 2011; Tezci, 2011; Yuena, & Ma, 2008; Wong, Teo & Russo, 2012) acceptance or adoption in using ICT facilities for their teaching and learning, little is done to investigate on the lecturers' adoption and gratification in using ICT facilities in higher education. In so doing, determinants such as perceived ease of use, perceived usefulness, computer self-efficacy, intention to use, use and gratification were postulated to be major barriers. To examine the effect of these factors on lecturers' ICT usage, the technology adoption and gratification (TAG) model was developed and validated. Finally, there is a lack of adequate facilities for the adoption and gratification of the infrastructure considered for this study to determine its implementation and use as experienced by the lecturers.

1.4 OBJECTIVES OF THE STUDY

This study was conducted to explore and understand factors that influenced lecturers' adoption and gratification of the comprehensive Public Universities' (University of Malaya in Malaysia and Jiaxing University in China) ICT usage, the relationships among perceived ease of use, perceived usefulness, computer self-efficacy, intention to use, use and gratification and how these constructs interacted to influence adoption and gratification framed within the TAG Model. Specifically, the objectives were to (1) develop and validate the Technology Adoption and Gratification (TAG) Model consisting of the constructs, namely, computer self-efficacy and gratification into the original TAM, (2) measure the lecturers' views on the ease of use of ICT facilities, (3) evaluate the lecturers' perception regarding the usefulness of ICT facilities, (4) examine the lecturers' computer self-efficacy to access ICT facilities, (5) examine the lecturer's intention to use of ICT facilities, (6) determine the lecturers' actual use of ICT facilities, (7) assess the lecturers' gratification in using ICT services at the public universities in Malaysia and China, (8) examine the cross-cultural validation of the TAG model in higher education.

1.5 RESEARCH HYPOTHESES

Based on existing literature review, the following research hypotheses were generated:

1. Computer self-efficacy (CSE) will have a positive direct influence on lecturers' perceived ease of use (PEU) and perceived usefulness (PU) of ICT facilities in higher education.
2. Perceived ease of use (PEU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.

3. Perceived usefulness (PU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.
4. Intention to use (INT) will have a positive direct influence on lecturers' gratification (GRAT) and actual use (USE) of ICT facilities in higher education.
5. Actual use (USE) will have a positive direct influence on gratification (GRAT) in using ICT services in higher education.
6. Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' intention to use (INT) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.
7. Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.
8. Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' use (USE) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.
9. Perceived ease of use (PEU) and Perceived usefulness (PU) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by intention to use (INT), respectively.
10. Intention to use (INT) will have a positive indirect influence on lecturers' gratification (GRAT) mediated by actual use (USE) of ICT facilities in higher education.
11. There will be a cross-cultural invariant of the causal structure of the TAG model.

The broad objective of this study was to develop and validate the Technology Adoption and Gratification (TAG) Model by incorporating two intrinsic motivation attributes, namely, computer self-efficacy and gratification into the original Technology Acceptance Model (TAM). The broad objective was achieved for this study through the specific objectives. To address the specific objectives, the present study generated eleven hypotheses as shown in Table 1.1.

Table 1.1: The list of Specific Objectives and Hypotheses

List of Specific Research Objectives related to Hypotheses	
The specific objectives were to measure the lecturers' views on the ease of use of ICT facilities and evaluate the lecturers' perception regarding the usefulness of ICT facilities.	To address the objectives 2 and 3, the present study hypothesized that: H2: Perceived ease of use (PEU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education. H3: Perceived usefulness (PU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education. H9: Perceived ease of use (PEU) and Perceived usefulness (PU) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by intention to use (INT), respectively.

Table 1.1, continued

The specific objective was to examine the lecturers' computer self-efficacy to access ICT facilities.	To address the objective 4, the present study hypothesized that: H1: Computer self-efficacy (CSE) will have a positive direct influence on lecturers' perceived ease of use (PEU) and perceived usefulness (PU) of ICT facilities in higher education. H6: Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' intention to use (INT) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively. H7: Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively. H8: Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' use (USE) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.
The specific objective was to examine the lecturer's intention to use of ICT facilities.	To address the objective 5, the present study hypothesized that: H4: Intention to use (INT) will have a positive direct influence on lecturers' gratification (GRAT) and actual use (USE) of ICT facilities in higher education. H10: Intention to use (INT) will have a positive indirect influence on lecturers' gratification (GRAT) mediated by actual use (USE) of ICT facilities in higher education.

Table 1.1, continued

	To address the objective 6, the present study hypothesized that:
The specific objective was to determine the lecturers' actual use of ICT facilities.	H5: Actual use (USE) will have a positive direct influence on gratification (GRAT) in using ICT services in higher education.
The specific objective was to assess the lecturers' gratification in using ICT services at the public universities in Malaysia and China.	To address the objective 7, the present study may not necessarily generate the hypothesis, which is an endogenous variable tested using Confirmatory Factor Analyses as well as Structural Equation Modeling like other objectives.
The specific objective was to examine the cross-cultural validation of the TAG model in higher education.	To address the objective 8, the present study hypothesized that: H8: There will be a cross-cultural invariant of the causal structure of the TAG model.

1.6 SIGNIFICANCE OF THE STUDY

This study has provided useful information on the lecturers of the public universities in Malaysia and China adoption of and gratification in using the universities' ICT facilities. This information can give insight to the universities authority and administration to better gauge the utility of the ICT services provided. This study has contributed significantly in getting the lecturers' perspectives on their adoption of and gratification in using the ICT facilities. This research exercise has comprised lecturers of all faculties of the University of Malaya in Malaysia and Jiaxing University in China; it is, therefore, comprehensive and representative in nature. The results will help the Universities' higher authority in taking and providing necessary steps towards training personnel regarding the application of this ICT service in higher education. Besides, this study will also contribute to the body of the knowledge by

developing and validating the technology adoption and gratification (TAG) model in higher education.

1.7 LIMITATION OF THE STUDY

The study was confined and limited to two public universities, namely, University of Malaya in Malaysia and Jiaxing University in China. Lecturers who work in the different faculties/colleges, namely, Arts and Social Sciences, Built Environment, Business and Accountancy, Computer Science and Information Technology, Dentistry, Economics and Administration, Education, Engineering, Language and Linguistics, Law, Medicine, Sciences, Academy of Islamic Studies, Foreign Language Studies, Mathematics and Engineering, Biology and Chemistry, Material Engineering, Education, Civil Engineering & Architecture and Jiaxing University Nanhu were sampled to evaluate their adoption of and gratification in using the ICT facilities for their teaching and research. However, this study did not include all lecturers due to the restriction of time.

1.8 OPERATIONAL DEFINITION OF TERMS

The following operational definitions were adopted in the study:

1. Perceived Ease of Use

   According to Davis (1989), perceived ease of use refers to the degree to which the user believes that using the technology would be free of effort. In this study, perceived ease of use (PEU) refers to the lecturers' perception of how easy it is to use the ICT facilities measured through items in the questionnaire.

2. Perceived Usefulness

   Perceived usefulness refers to the degree to which a person believes that using

the technology would enhance his or her performance (Davis, 1989). In this study, perceived usefulness (PU) refers to the lecturers' perception of the benefits derived from using the ICT services measured through items in the questionnaire.

3. Computer self-efficacy

In this study, computer self-efficacy (CSE) refers to the lecturers' beliefs in their computer ability to use the ICT facilities measured through items in the questionnaire.

4. Intention to Use

In this study, intention to use (INT) refers to the lecturers' perception of how the ICT facilities are examined in terms of the likelihood of lecturers' use of such facilities for enhancing their teaching, learning and researching ability as measured through items in the questionnaire.

5. Gratification

In this study, the extent to which the usage of ICT is consistent with existing values, needs and the experience of the lecturers' which will be measured through items in the questionnaire.

6. Actual Use

In present study, actual use (USE) refers to the lecturers' view of how frequently they use ICT facilities for their research and academic-related activities in higher education as measured through items in the questionnaire.

7. ICT facilities

The ICT facilities have been provided by the authorities of University of Malaya in Malaysia and Jiaxing University in China, respectively. ICT

facilities include computers, web browser (WWW), search engine (e.g. Google, Yahoo, etc.), Microsoft office applications, document processing, editing and composing, email and wireless internet, research related software, computer graphics, computer labs, multimedia facilities (CD-ROM, VCD, DVD), and university research databases. The research databases comprise volumes of research articles and reports published in journals. It also includes thesis and dissertations that would be helpful for lecturers and staff to conduct thorough literature reviews. In addition, it also helps lecturers to get access to their subject related research materials which give them extra assistance in their teaching, learning and research.

8. University Lecturers

This refers to the lecturers of the University of Malaya and Jiaxing University who are currently working as professors, associate professors, assistant professors or senior lecturers and lecturers at the different faculties or colleges which were measured through items in the questionnaire.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides an overview of the information and communication technology usage, Technology Acceptance Model (TAM), and its constructs. It then briefly defines the Technology Satisfaction Model (TSM) as well as Online Database Adoption and Satisfaction (ODAS) Model. It is followed by a detailed description of the conceptual model as proposed in this study, and its constructs to develop and validate the Technology Adoption and Gratification (TAG). This section is capped with an overview of the construction of hypotheses.

2.2 INFORMATION AND COMMUNICATION TECHNOLOGY USAGE

In a study by Elen, Clarebout, Sarfo, Louw, Pöysä-Tarhonen, and Stassens (2010), the definition of information communication technology (ICT) was cited from Wikipedia (retrieved May 25 2009) and stated that "Information and communication technologies (ICT) is an umbrella term that includes all technologies for the manipulation and communication of information. The term is sometimes used in preference to Information Technology (IT), particularly in two communities: education and government. In the common usage it is often assumed that ICT is synonymous with IT; ICT in fact encompasses any medium to record information (magnetic disk/tape, optical disks (CD/DVD), flash memory etc. and arguably also paper records); technology for broadcasting information - radio, television; and technology for communicating through voice and sound or images - microphone,

camera, loudspeaker, telephone to cellular phones. It includes the wide variety of computing hardware (PCs, servers, mainframes, networked storage), the rapidly developing personal hardware market comprising mobile phones, personal devices, MP3 players, and much more; the gamut of application software from the smallest home-developed spreadsheet to the largest enterprise packages and online software services; and the hardware and software needed to operate networks for transmission of information, again ranging from a home network to the largest global private networks operated by major commercial enterprises and, of course, the Internet. Thus, "ICT" makes more explicit that technologies such as broadcasting and wireless mobile telecommunications are included.

According to Zhou et al., (2011), like many other countries, the Chinese government also granted enormous attention and significance to educational technology. In order to accelerate their post-secondary institutions' technology popularizing rate, the China Educational Technology in Higher Education Committee was established by its Ministry of Education in December 1999. One year later, a program of Connecting Every School which devoted to connect 90% of their schools onto the Internet was launched for school level. So, high quality online educational resources can be obtained by their students and teachers within the next five to ten years. Further, in 2002, a series of educational technology norms were formulated by the Ministry for the purpose of guiding the practical technology application for school teachers, facilitators, as well as administrators, which was followed by the publication of National Educational Technology Standards put forward firstly by the International Society for Technology in Education (ISTE) for teachers and students in 2000. The research they conducted revealed some positive viewpoints as well as problems of technology and its use among school teachers. In detail, the positive perspectives can

be reflected from the following findings: nearly 90% of participators confirmed the useful role of technology in teaching process; more than 80% agreed teachers need to learn how to integrate technology into teaching practices, and 77% identified that it was significant for school students to learn technology. On the contrary, only 11% stated that they are proficient in using technology and lower than 17% were self-confident with the use of technology. In addition, compared with the fact that most of the participators knew technology could be a helpful teaching tool, only 9% felt skillful to adopt it in actual teaching activities. Thus, strong confidence and ability in using technology did not assist in direct proportion to the optimistic opinions. Moreover, the insufficient technological preparation for teaching was frequently pointed out by focus group participants. They also uncovered that the participants' education program did not work well in helping them to apply technology in teaching. However, concerning the use of technology in teaching, they shared similar viewpoints, and their suggestions on how to integrate technology in teacher education was not very different to what had been discussed in other countries. Consequently, the technology course should be re-constructed by the teacher education program to tackle the participants' concerns. In order to acquire technology skills more effectively, it is necessary for teaching candidates to seek better ways of compounding the lecture and lab components.

Du Plessis and Webb (2012) claimed that there is a growing number of schools that have been established with ICT infrastructure, and there is an increasing necessity for the teachers' professional development in ICT. As a result information on ways to assist teachers, especially those who are digital immigrants, is needed to help them deal with the demands of the curriculum and the 21st century skills implied therein. Nevertheless, they highlighted the caveat that the execution of ICT associated

techniques may not be a one-off event, and that the participants require dissimilar levels of support and training (professional ICT teacher development), generally in a planned manner, to attain the confidence and competence obligatory to use innovative ICT strategies effectively. Against this backdrop, they examined whether revelation to an Internet based extended Cyberhunt strategy allows teachers to achieve a set of outcomes related to Prensky's 'Essential 21st Century Skills' and the 'Critical Outcomes of the South African National Curriculum Statement (NCS)'. The outcomes comprised effective planning, designing, decision making and goal setting; improved computer and data searching skills; enhanced confidence, interest, reflective ability, collaboration, judgment and creative and critical thinking; as well as effective problem solving and the ability to communicate and interact with individuals and groups. The quantitative and qualitative data were collected from 26 school teachers, even though the sample size was not adequate. The findings of their study demonstrated statistically significant gains in increasing each teacher's decision making, searching skills, ability to compose questions on dissimilar cognitive levels, planning ability, notion of audience, computer skills, confidence, reflective ability, interest, and collaboration skills. The results also show that learning by the design context prepared the respondents conscious of the inconsistencies that are linked with the traditional teaching environment and were made aware of the affirmative likelihoods that a diverse ICT related approach might provide for learning.

Eyal (2012) observed teacher's skills, abilities, and perceptions required in the digital environment through assessment, and showed the significance of adapting the different technologies to the dissimilar estimation purposes. In the study, Eyal (2012) concluded the significances of teachers in the digital learning environment are: a) the role of teachers who appreciate the digital learning environments is primary and

significant; b) wise use of technological tools to assess learners is essential for the students, teachers, and for other students participating in educational processes; c) teachers in the 21st century prefer to use technologies that advance the assessment methods which emphasize the learning process, enable peer assessment and develop reflective abilities. Eyal also articulated that teachers are obliged to have some abilities and skills in basic, advance and intermediate digital assessment literacy, although there was no empirical assessment.

Afshari, Bakar, Luan and Siraj (2012) affirmed that despite the significance of computer use in education and the role of the principals of the schools in assisting technology assimilation, there has been little study on the use of ICT by the principal themselves, their computer competencies as well as their transformational leadership role in implementing ICT in schools. As such, they conducted an empirical research to observe whether the transformational leadership role of principals in implementing ICT in secondary schools was affected by the computer competence, level of computer use, and the professional development activities of the principals. The data for their study were gathered from 320 secondary school principals in Iran. To develop and validate the research model, a structural equation modeling was applied to test five hypotheses. Their findings exhibited that computer competence had a significant effect on secondary school principals' computer use and it indirectly influenced the transformational leadership role of principals in implementing ICT in schools, while it did not show any significant direct effect on transformational leadership as hypothesized. Thus, It recommended that continuing professional development opportunities on the subject of leadership and technology must be provided for principals to enhance their levels of ability in computer use which might assist future study comprehending the significance of the use of technology in

education which may further lead to the discovery of model that include the transformational leadership dimensions of charisma, inspirational motivation, intellectual stimulation and individualized contemplation in their schools.

Kregor, Breslin and Fountain (2012) conducted a study with regards to e-learning practice, demand and capacity which aims to improve planning, decision making and the quality of the online experience. A total of 2,300 students and 250 staff members participated in the study conducted at the University of Tasmania (UTAS) in Australia. The findings of their study on technology use presented information about the overall familiarity on various regular and irregular technology usages from students and staff. An indication can be perceived from the usage records and trail on how easily adopted a technology might be if it is known as an innovative way of teaching and learning, or on the contrary, how much endeavor would be required to increase usage and acceptance. Most of the staff and students were web users on a daily or at least regular basis for information searching and general reference, online transactions like shopping, banking and email. On the other hand, a large number of students showed satisfaction on the availability of computers and the wireless network at UTAS. A slightly greater minority (30%) found that applying technology in courses sometimes challenged their IT skills. Staff were obviously unsatisfied with their experience because 50% of the staff believed that the workload associated with e-learning did not involve adequate recognition and planning; compared to only 18% who did and 42% did not consider learning spaces to be physically appropriate for "innovative use of learning technology", while 18% held the opposite opinion. They also found teaching staff were somewhat less convinced that the integration of ICT and the online environment in teaching and learning is beneficial to learners. Therefore, in order to advance more effective and broader use

of technology at the university, the support of teaching staff is crucially significant.

Jang and Tsai (2013) studied the technological pedagogical and content knowledge (TPACK) of science teachers in secondary schools employing a new contextualized TPACK model. The research model consisted of four factors: content knowledge (CK), pedagogical content knowledge in context (PCKCx), technology knowledge (TK) and technological pedagogical content knowledge in context (TPCKCx). The contextualized TPACK model was tested using a total of 1292 science teachers from Taiwan. Their findings discovered that the four underlying factors were consistent with prior study. The results also showed that (the percentage of use of computer technology) computer technology was employed by 94.6% of secondary school science teachers in Taiwan. However, the technology knowledge and technological content knowledge in context rated by science teachers with less teaching experience tended to be considerably higher than that by teachers with more teaching experience.

According to Kreijns et al., (2013), the introduction of novel pedagogical practices which complied with 21st knowledge society's educational demands can be enabled, supported and reinforced by Information and communication technology (ICT). Thus, teachers are expected to employ ICT pedagogically. On the contrary, they feel more often reluctant rather than willing to use ICT, even though the level of ICT infrastructure increases and this potential skills-based professional development is delivering. The Technology Acceptance Model (TAM) and its descendants TAM2 and TAM3 are frequently applied to expand insight into the dimensions effecting acceptance of a specific technology. TAM's fundamental constructs are perceived ease of use and perceived usefulness. TAM is primarily a technology-oriented model which overlooks various factors that might explicate why teachers are not willing to

use ICT. In doing so, they alternatively proposed the application of Fishbein's (2000) Integrative Model of Behaviour Prediction (IMBP). The IMBP consisted of attitude, self-efficacy and subjective norm that are the direct and indirect predecessors of intention to use of ICT and actual ICT usage. Nevertheless, there was no empirical validation for their proposed research model in the domain of teachers' intention to pedagogically use an ICT object. They suggested that if teachers are short of knowledge and skills, then it would hint that the most significant concerns for interfering are self-efficacy and its antecedent factors.

According to Fu (2013), Information and Communication Technology (ICT) is broadly employed in the current educational fields, including computers, the Internet, and electronic delivery systems like televisions, radios, projectors, and more. As such, Fu's study made a summarization of the pertinent researches on the application of information and communication technology (ICT) in educational fields. Particularly, the research looked at studies that mentioned the advantages of integrating ICT into schools, the factors affecting successful ICT integration, the challenges and difficulties faced in using ICT, the significance of school culture in using ICT as well as pre-service and in-service teachers' perceptions, attitudes, and confidence in the use of ICT. Based on the information gathered, Fu (2013) concluded that it is obvious that ICT integration is not one-off task, but is adjustable and it is an evolving process. Moreover, only few studies have focused on challenges of ICT integration faced by teachers, students and administrative when they participated in specific teaching activities. Thus, further investigation is required in this area by future researchers.

Buabeng-Andoh (2012) examined teachers' adoption and integration of information and communication technology in teaching and learning processes. The author explained several factors that prevent teachers from using ICT such as: the lack

of ICT skills, confidence, pedagogical teacher training, suitable educational software, access, rigid structure of traditional education systems and restrictive curricula. However, there was no empirical assessment to generalize this research. The study concluded that the adoption and integration of technologies by classroom teachers has been complicated because of its fast progress. Teachers are challenged by the efficient integration of technology into classroom practices which required more than just connecting computers to a network. In addition, teachers' intentions to apply technology in their teaching practice or attitude toward technology is the key factor in the study. Providing teachers who have negative attitudes toward technology with excellent ICT facilities may not have an influence on their use of it in their teaching. Thus, it is necessary to assure teachers that their teaching can be made interesting, easier, more fun, more motivating and more enjoyable through technology.

Lim and Pannen (2012) carried out a research to find out how the Indonesian teacher education institutions (TEIs) applied strategic planning to improve their capability in developing pre-service teachers' educational competence in ICT usage. A holistic method was adopted towards strategic planning by these TEIs through utilizing the six dimensions of the Capacity Building Toolkit for TEIs in the Asia Pacific. Among them, the pre-service teacher education program (practicum, curriculum and assessment) is the key dimension of the strategic planning which is motivated by the philosophy and vision of the TEI. ICT plan, professional learning, research and evaluation, and communication and partnerships are four other dimensions supporting the program. The development of pre-service teacher education programs were focused on by three of the four TEIs' strategic planning, while research and evaluation was focused on by one. During this process, support from management was essential to the TEIs, but they also faced challenges from senior staff

because they were reluctant to change, lack of funding, and less qualified.

On the basis of Gibson, Stringer, Cotton, Simoni, O'Neal, and Howell-Moroney (2014), helping students to use technology as a learning tool is a significant aim of incorporating computer usage into daily classroom tutoring. Except access to computers, teachers' implementation of computing into learning can also lead to fruitful classroom integration. The teachers' belief on classroom computing affects successful implementation greatly. Therefore, they determined the impacts of a teacher-focused technology intervention on the students' computer usage, anxiety and attitudes towards learning tools, while Teachers' classroom computer usage, attitudes and anxiety were investigated as mediators of this relationship. They predicted that increased teacher participation will have a statistically significant influence on students' educational use of computers and attitudes towards classroom computing, and reduce student anxiety towards computing. On the other hand, the relationship between the student outcomes and interventions were mediated by teachers' computer usage, anxiety and attitudes towards classroom computing. To test the hypotheses, a total of 696 students and 60 teachers were collected using survey questionnaire. The findings of their study found that the technology intervention had a significant influence on the students' computer usage and attitudes for educational purposes. Nonetheless, there was no confirmation that teachers' attitudes or use had any mediating impact on this relationship. The findings also suggest that it is possible to enhance learners' attitudes toward computer use through intense interventions aimed at their educators.

Kim, Choi, Han and So (2012) stated that since the initiation of the first IT Master Plan of Korea in 1996, teachers there are commonly deemed well trained to incorporate ICT into their teaching practice. Therefore, they investigated novel

educational measures to improve teachers' ICT capacities in the contemporary learning atmosphere. The literature showed that innovative and efficient adaptive expertise and novel media literacy skills are the new requirements for teachers. Under this consideration, three cases were observed: (1) learning *Scratch* for computational and creative thinking, (2) learning robotics as emerging technology requires convergent and divergent thinking, and (3) learning to design with ICT systems thinking. Thus, some new methods helped teachers to fostering adaptive expertise, for example, offering a variety of contexts unlike usual classroom lessons, and emphasizing on thinking skills instead of technical skills. However, difficulties were also encountered by participants in the above three cases, such as problems in handling different course activities, incorporating new ideas, and comprehending new design contexts in their comprehensive projects. They suggested that in order to validate the challenges and potentials of those methods, it is compulsory to look into teachers' learning processes and their outcomes with a wider variety of cases with more depth and with more sources of data.

Bringula and Basa (2011) studied the determinants that may significantly influence faculty web portal usability. The data for their study was collected from 82 faculty members of the University of the East-Manila in Philippine. Descriptive analysis demonstrated that the majority of the faculty members were moderately young, were holders of Master degree, were experts in using the internet and computers, were dedicated in usage of the web portal, and had internet access at home. The outcome of their multiple regression analysis discovered the only way to predict web portal usability was information content, as a web portal design-related factor. Therefore, the null hypothesis, defining that web portal design-related and faculty-related dimensions do not have significant impact on faculty web portal usability, is

well-received. They recommended that the search for accounts of low usability of faculty web portals by the internet-connected, dedicated and expert faculty staff was worth further investigation.

Goktas, Gedik and Baydas (2013) conducted a research to explore the difficulties faced in the integration of ICT by Turkish primary school teachers, to make a comparison between the present (in 2011) condition of ICT integration and that in 2005, and to recommend possible enablers to solve those difficulties. A total of 1373 teachers were collected from 52 schools in 39 provinces in Turkey. The findings of their study exhibited that the lack of hardware, appropriate software materials, limitations of hardware, in-service training, and technical support were the most significant difficulties. Besides this, the maximum ordered enablers were allocation of more budgets, specific units for peer support, support offices and personnel for teachers and higher quality pre-service training for ICT. Additional leading enablers were supporting teachers to enable effective ICT use, having technology plans, offering higher quality and more quantity of in-service training and designing appropriate course content/instructional programs. The results also showed that the majority of barriers indicated statistically significant differences and most enablers demonstrated moderate or low differences between teachers' views of their situation in 2005 and in 2011. Their study recommended that in order to help teachers incorporate ICT into their teaching practice more efficiently, technical support should be provided to them. Moreover, online system supports, special ICT units, and personnel allocation should be focused to facilitate them (besides tutor teachers). And, to improve the quality of in-service training programs, further approaches should be taken. Additionally, it should be mandatory for both teachers and administrators to attend the in-service training programs for classroom ICT application.

2.3 TECHNOLOGY ACCEPTANCE MODEL (TAM)

The technology acceptance model (TAM) was rooted in the theory of reasoned action (TRA), a model concerned with determinants of consciously intended behaviors (Fishbein & Ajzen, 1975). TRA states that beliefs influence attitudes, which in turn lead to intentions and then generate behaviors. TAM assumes that beliefs about usefulness and ease of use are always the primary determinants of Information Technology/Information System adoption in organizations. According to TAM, these two determinants serve as the basis for attitudes towards a particular system, which in turn determines the intention to use, and then generates the actual usage behavior. The model is shown in Figure 2.1. However, the Technology Acceptance Model (TAM) developed by Davis (1989) ignored the issue of computer self-efficacy and satisfaction (Islam, 2014). Moreover, the findings of the Online Database Adoption and Satisfaction (ODAS) Model (Islam, 2011a) contributed to a better understanding of the TAM and technology adoption among postgraduate students by incorporating two intrinsic motivation attributes, namely, computer self-efficacy and satisfaction.

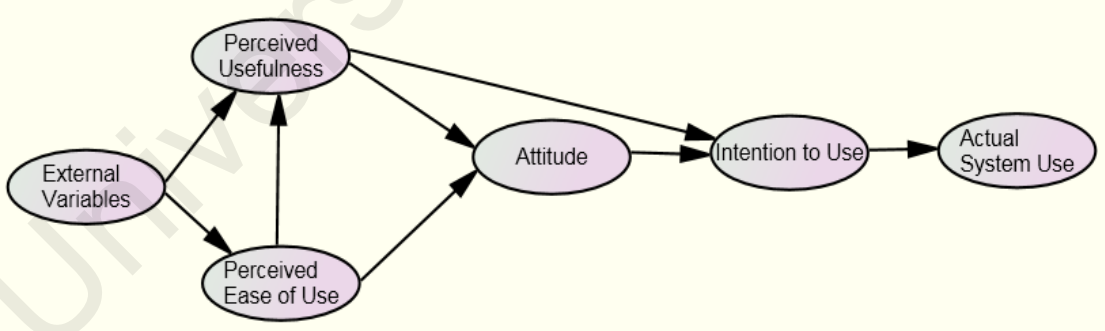

Figure 2.1: Technology Acceptance Model (Davis et al. 1989)

Furthermore, many researchers have extended the TAM by incorporating additional constructs for measuring e-Learning systems (Lee et al., 2011; Alenezi et al., 2010; Martínez-Torres et al., 2008; Yuena & Ma, 2008), ICT usage (Tezci, 2011; Ahmad et al., 2010; Terzis et al., 2013; Zejno & Islam, 2012; Usluel et al., 2008;

Wong et al., 2012; Al-Ruz & Khasawneh, 2011), Social Networks (Shipps & Phillips, 2013; Shittu, Basha, Rahman & Ahmad, 2013; Shittu et al., 2011), mobile learning (Chang, Yan & Tseng, 2012; Wang, Lin & Luarn, 2006; Aljuaid, Alzahrani & Islam, 2014), online learning (Chang & Tung, 2008; Guo & Stevens, 2011; Rasimah et al., 2011), Internet banking (Amin, 2007), e-Commerce (Devaraj, Fan & Kohli, 2002; Lallmahamood, 2007; Lee & Park, 2008), wireless internet (Islam, 2011b; Islam, 2014), online shopping (Barkhi, Belanger & Hicks, 2008; Stone & Baker-Eveleth, 2013), mobile banking (Kumar & Ravindran, 2012; Chitungo & Munongo, 2013; Hanafizadeh, Behboudi, Koshksaray & Tabar, 2014), online research databases (Islam, 2011a; Islam et al., 2015) and YouTube (Lee & Lehto, 2013). The summary of these studies are shown in Table 2.1. However, most of these studies are concerned with the acceptance or adoption of technological applications from the perception of school teachers, students as well as consumers, while, very few studies examined the lecturers' adoption and gratification in using ICT facilities for their teaching and research purposes in higher education.

Teo (2011) extended the technology acceptance model (TAM) by including two additional constructs, namely, subjective norm and facilitative conditions to measure school teachers' intention to use technology. The research model for this study incorporated six factors, namely, perceived usefulness, perceived ease of use, subjective norm, facilitative conditions, attitude and behavioural intention to test all nine hypotheses. The sample used in Teo's study consisted of 592 teachers from schools in Singapore. The research model was estimated using the structural equation modeling. The findings of this study discovered that perceived usefulness, attitude towards use, and facilitating conditions had direct influences on teachers' behavioural intention to use technology, while subjective norm and perceived ease of use had

significant indirect effect on behavioural intention to use technology mediated by attitude towards use and perceived usefulness, respectively. From the direct effects, it was obvious that when teachers perceive technology to be useful and that applying technology would enhance their productivity, similarly, their intention to use will be drastically improved. A positive attitude also showed a positive and direct effect on teachers' behavioural intention to use technology, while subjective norm did not exert any significant influence on behavioural intention. Teo (2011) also suggested that with the use of technology in education becoming pervasive internationally, proportional studies across countries or cultures could be conducted to discover the culture-invariant variables that effect teachers' intention to use technology.

Lai and Chen (2011) asserted that there has been recently a remarkable propagation in the number of teaching blogs; nonetheless, little has been discovered about what encourages teachers to adopt teaching blogs. As a result, they conducted a study to assess secondary school teachers' adoption of teaching blogs. To examine teachers' adoption, they extended Rogers' (1995) Innovation Diffusion Theory (IDT) to develop and validate their research model which integrated four main dimensions, namely, individual (codification effort, loss of knowledge power, reputation, enjoyment in helping others, knowledge self-efficacy and personal innovativeness), technological (perceived usefulness, perceived ease of use, compatibility and perceived enjoyment), school (school support and school incentives) and environmental (supervisor influences and peer influence) characteristics to test the hypotheses. To estimate the research model, survey data were collected from a total 325 secondary school teaching blog adopters and secondary school teachers and analyzed using discriminant analysis. The findings of their study demonstrated that the secondary school teachers' decisions to adopt teaching blogs were strongly related to

eight constructs, namely, perceived enjoyment, codification effort, compatibility, perceived ease of use, personal innovativeness, enjoyment in helping others, school support and perceived usefulness. It was found that self-efficacy did not significantly influence teaching blog adoption among others. The results also showed that perceived ease of use and usefulness were important factors for teachers to adopt teaching blogs. If teachers observe teaching blogs easy to use and useful, they are much more likely to use and update their blogs, effecting decisions regarding teaching blog adoption. However, their study indicated that still very few teachers were used teaching blogs.

Lee and Lehto (2013) modified the TAM to examine users' behavioral intention to use YouTube. Their conceptual model integrated user satisfaction, task-technology fit, vividness, YouTube self-efficacy, as well as one second-order factor of content richness into the TAM. A total of 432 participants were collected in their study. The data for their study were analyzed using structural equation modeling to validate the extended TAM. The findings of their study showed that users' perceived usefulness of YouTube was significantly influenced by task-technology fit, vividness and content richness, while behavioral intention to use was affected by user satisfaction and perceived usefulness. Users' perceived usefulness had a significant effect on satisfaction whereas YouTube self-efficacy showed a moderate effect on usefulness. However, perceived ease of use did not have a significant influence on either perceived usefulness or intention to use of YouTube.

Mac Callum and Jeffrey (2013) investigated how ICT skills influenced university students' adoption of mobile technology in the tertiary learning environment. An extended TAM was applied as a theoretical framework of their study. The hypothesized model included ICT self-efficacy (basic ICT skill, advanced ICT

skill & advanced mobile skill) into the TAM. A total of 446 students were collected using stratified convenience sampling procedure from three tertiary institutions in New Zealand. The questionnaire was distributed via electronic methods. The hypothesized model was validated using structural equation modeling to test twelve hypotheses and their causal relationships. The findings of their study confirmed that students' behavioral intention to adopt mobile learning was influenced by three factors which were: perceived ease of use, perceived usefulness and basic ICT skill. However, perceived ease of use and basic ICT skill had a moderate influence on intention to adopt. Besides this, basic ICT skill and advanced mobile skill were moderately significant factors of mobile learning adoption.

In a recent study, Suki, Ramayah, Nee and Suki (2014) studied consumer intention to use anti-spyware software. Their theoretical framework was developed based on the innovation diffusion theory and the theory of planned behavior, which consisted of relative advantage, moral compatibility, ease of use, subjective norms, image, computing capacity, perceived cost, trialability and intention to use the anti-spyware software. The theoretical framework was tested using data collected from the survey questionnaire that engaged 200 students studying in a comprehensive public university in Malaysia. Data were analyzed using structural equation modeling to validate eight hypotheses of the model. The findings of their study revealed that students' perceived cost, image, moral compatibility and ease of use were significant determinants of students' intention to use anti-spyware software, while relative advantage and subjective norms negatively influenced students' intention to use anti-spyware software. However, computing capacity and trialability did not have an influence on consumer intention to use anti-spyware software in higher education.

Niu (2014) examined adolescents' shopping in cyberspace. One of the purposes of this study was to identify the influence extent of the perceived use of technology applied by shopping websites on buyers' buying behavior. In doing so, the TAM was used as a moderating variable. She hypothesized that perceived ease of use and perceived usefulness moderate the relationship between teenage consumers' decision-making styles and purchasing behavior. The results of her study confirmed the moderating influences of perceived usefulness and ease of use. However, perceived ease of use and usefulness moderately influenced adolescents' purchasing behavior.

Lee, Hsiao and Purnomo (2014) extended the TAM by including additional factors of internet self-efficacy, computer self-efficacy, instructor attitude toward students, learning content and technology accessibility to investigate students' acceptance of e-learning systems. Their proposed research model was validated using Structural Equation Modeling to test altogether eleven hypotheses. The findings of their model confirmed that students' perceived usefulness and ease of use had significant effect on intention to use e-learning systems, while perceived usefulness and ease of use were positively influenced by learning content. On the other hand, computer self-efficacy had a significant effect on perceived ease of use but it had a negative insignificant effect on perceived usefulness. Subsequently, perceived ease of use and usefulness were moderately influenced by internet self-efficacy. However, instructor attitude towards students showed an insignificant impact on perceived usefulness. Eventually, perceived ease of use was moderately influenced by technology accessibility, while it did significantly influence perceived usefulness. Their suggestions for researchers demonstrated that the individual characteristics of computer self-efficacy and internet self-efficacy play crucial roles in influencing user

beliefs about ease of use.

In a related study, Pynoo, Tondeur, Braak, Duyck, Sijnave and Duyck (2012) developed and validated their theoretical framework based on a combination of Theory of Planned Behavior (TPB) and Technology Acceptance Model (TAM) to examine teachers' acceptance and use of an educational portal. Their theoretical framework was consisted of perceived usefulness, perceived ease of use, subjective norms, perceived behavioral control, attitude, behavioral intention and self-reported frequency of use. A total of 919 teachers were collected for their study. The research model was estimated using path analyses. The results of their study indicated that perceived usefulness, perceived ease of use, subjective norms, perceived behavioral control, attitude and behavioral intention to use influenced teachers' acceptance of a portal. Teachers' perceived usefulness and attitude were the most significant predictors of intention to use the portal. The findings also showed that rather than uploading or sharing information, the portal was used to search for and download information by the teachers. While, few teachers indicated to browse through the portal for fun, or without a precise goal.

Table 2.1: The Summary of TAM Literature Matrix

Authors	Titles	Sample	Constructs Measured	Major Findings
Davis, Bagozzi and Warshaw (1989)	User acceptance of computer-technology: A comparison of two theoretical models.	107 MBA students	External variables, Perceived usefulness, Perceived ease of use, Attitude toward using, Behavioral intention to use, Actual system use	Perceived usefulness strongly influenced students' intentions, explaining more than half of the variance in intentions. Perceived ease of use had a small but significant effect on intentions as well, while this effect subsided over time. Attitudes only moderately mediated the effects of these beliefs on intentions. Subjective norms had no effect on intentions.
Lee and Park (2008)	Mobile technology usage and B2B market performance under mandatory adoption	86 useful responses from alcoholic beverage wholesaler	Perceived usefulness, Perceived ease of use, Perceived loss of control, User satisfaction, Perceived market performance	Combining perceived loss of control with user satisfaction and the TAM in a single model can better explain the Business-to-Business (B2B) transaction market performance model. The findings suggested that perceived loss of control has a negative effect on user satisfaction and perceived market performance is influenced by user satisfaction and perceived usefulness.
Lee and Lehto (2013)	User acceptance of YouTube for procedural learning: An extension of the Technology Acceptance Model	432 YouTub users	Perceived ease of use, task-technology fit, content richness, vividness, and YouTube specific self-efficacy, behavioral intention, perceived usefulness, and user satisfaction	Behavioral intention was significantly influenced by both perceived usefulness and user satisfaction. Task-technology fit, content richness, vividness, and YouTube self-efficacy were discovered to be significant predictors of perceived usefulness. Nevertheless, perceived ease of use was not significantly predictive of either perceived usefulness or behavioral intention.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Hanafizadeh, Behboudi, Koshksaray and Tabar (2014)	Mobile-banking adoption by Iranian bank clients	361 bank clients	Perceived usefulness, perceived ease of use, need for interaction, perceived risk, perceived cost, compatibility with life style, perceived credibility, trust and intention to use mobile	Perceived usefulness, perceived ease of use, need for interaction, perceived risk, perceived cost, compatibility with life style, perceived credibility and trust successfully explain the adoption of mobile banking among Iranian clients. Adaptation with life style and trust were revealed to be the most significant antecedents explaining the adoption of mobile banking.
Gultekin (2011)	Technology Acceptance and the Effect of Gender in the Turkish National Police: The Case of the polnet system	407 police officers	Perceived usefulness, perceived ease of use, subjective norm and intention to use	The findings demonstrated that gender has no significant effects on behavioral intention to use POLNET. Besides, the effects of perceived usefulness, perceived ease of use and subjective norm do not differ between male and female police officers.
Al-Ruz and Khasawneh (2011)	Jordanian Pre-Service Teachers' and Technology Integration: A Human Resource Development Approach	1,008 pre-service teachers	Modeling of technology in Teacher education courses, technology self-efficacy, technology proficiency, usefulness of technology, overall support, technology integration and technology availability	The results indicated that the modeling of technology was a highly influential construct effecting pre-service teachers' technology self-efficacy, technology proficiency, and usefulness of technology. Technology self-efficacy was the most important factor with the highest direct effect on technology integration. Moreover, the support structure was the most influential factor with the highest direct effect on technology integration.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Stone and Baker-Eveleth (2013)	Students' intentions to purchase electronic textbooks	1,382 students from a mid-sized university	Ease of use, attitude toward e-textbooks, behavioral intentions to purchase e-textbooks, outcome expectancy/usefulness, verbal persuasion/social norms, self-efficacy and previous computer experience	The findings demonstrated that both ease of e-textbook use and verbal persuasion/social norm positively influenced behavioral intentions on purchasing e-textbooks through both self-efficacy and outcome expectancy/usefulness. Previous computer experience positively influences behavioral intentions to purchase an e-textbook only through self-efficacy
Lee, Hsieh and Hsu (2011)	Adding Innovation Diffusion Theory to the Technology Acceptance Model: Supporting Employees' Intentions to use E-Learning Systems	552 business employees	Perceived usefulness, perceived ease of use, intention to use, compatibility, complexity, relative advantages, observability and trialability	The findings revealed that five perceptions, namely, compatibility, complexity, relative advantages, observability and trialability of innovation characteristics significantly influenced employees' e-learning system behavioral intention. The effects of the compatibility, complexity, relative advantage, and trialability on the perceived usefulness are significant. Moreover, the complexity, relative advantage, trialability, and complexity on the perceived ease of use have a significant influence.
Chitungo and Munongo (2013)	Extending the Technology Acceptance Model to Mobile Banking Adoption in Rural Zimbabwe	275 rural consumers	Perceived ease of use, perceived usefulness, relative advantages, perceived risk, personal innovativeness, social norms and perceived cost	The results showed that perceived usefulness, perceived ease of use, relative advantages, personal innovativeness and social norms have significant influence on users' attitude thus effect the intention toward mobile banking, whilst perceived risks and costs deterred the adoption of the service.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Alenezi, Karim and Veloo (2010)	An Empirical Investigation into the Role of Enjoyment, Computer Anxiety, Computer Self-Efficacy and Internet Experience in Influencing the Students' Intention to Use E-Learning: A Case Study from Saudi Arabian Governmental Universities	402 governmental universities' students	Enjoyment, computer anxiety, perceived usefulness, perceived ease of use, computer self efficacy, internet experience, attitude toward using E-learning and behavioral intention to use E-learning	The findings showed that computer anxiety, computer self-efficacy and Enjoyment significantly influenced the students' intention to use E-learning, while the Internet experience was of insignificantly influence. In addition, the significance of Attitude in mediating the relationship between perceived usefulness, perceived ease of use and the students' behavioral intention was confirmed.
Davis (1993)	User acceptance of information technology: system characteristics, user perceptions and behavioral impacts	122 professional and managerial employees	System design features, perceived usefulness, perceived ease of use, attitude toward using and actual system use	The results showed that TAM completely mediated the effects of system characteristics on usage behavior. Possibly the most striking finding was that perceived usefulness was 50% more significant than ease of use in determining usage.
Tezci (2011)	Factors that influence pre-service teachers' ICT usage in education	1898 pre-service teachers	Computer attitude, internet attitude, self-confidence, school climate/support, ICT usage, ICT knowledge	The findings showed that most pre-service teachers reported that they use only basic ICT applications for educational purposes. Internal and external factors were found to be related to each other and to ICT usage levels. Moreover, male pre-service teachers' knowledge and usage levels of ICT were higher than female teachers.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Shin (2012)	3DTV as a social platform for communication and interaction	229 users of 3DTV	Social presence, perceived enjoyment, perceived quality, flow, perceived usefulness, attitude, intention, usage	The results indicated that the significant roles for social presence and flow, both of which influenced attitude as well as perceived usefulness and perceived enjoyment. This set of factors is key to users' expectations of 3DTV.
Martínez-Torres, Marín, García, Vázquez, Oliva and Torres (2008)	A technological acceptance of e-learning tools used in practical and laboratory teaching, according to the European higher education area	220 students	Use, Intention of use, Perceived usefulness, Ease of use, Methodology, Accessibility, Reliability, Enjoyment, User adaptation, Communicativeness, Feedback, Format, Interactivity and control, Diffusion and User tools	The findings strongly support the extended TAM in predicting a student's intention to use e-learning and define a set of external variables with a significant influence in the original TAM variables. However, perceived ease of use did not posit a significant impact on student attitude or intention towards e-learning tool usage.
Ahmad, Basha, Marzuki, Hisham and Sahari (2010)	Faculty's acceptance of computer-based technology: cross-validation of an extended model	731 faculty members	Self-efficacy, perceived usefulness, intention, use	The results supported the adequacy of the extended technology acceptance model (TAME). Although the TAME's causal structure was valid to both male and female staff, age groups showed moderate structural relationships among the constructs of interest.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Shroff, Deneen and Ng (2011)	Analysis of the technology acceptance model in examining students' behavioural intention to use an e-portfolio system	72 students	Perceived usefulness, perceived ease of use, attitudes towards usage and behavioural intention to use	The results confirmed that students' perceived ease of use had a significant influence on attitude towards usage. Consequently, perceived ease of use had the strongest significant influence on perceived usefulness.
Shipps and Phillips (2013)	Social Networks, Interactivity and Satisfaction: Assessing Socio-Technical Behavioral Factors as an Extension to Technology Acceptance	164 students	Perceived usefulness, perceived ease of use, attitudes, satisfaction, concentration focus, personal involvement, perceived interactivity communication and perceived interactivity control	The results showed that perceived interactivity and level of focus/concentration do affect an end user's satisfaction with a social network along with antecedents from the technology acceptance model. These findings suggested that both TAM related factors and marketing related factors both impact the user experience on a social networking site.
Chang, Yan and Tseng (2012)	Perceived convenience in an extended technology acceptance model: Mobile technology and English learning for college students	158 college students	Perceived convenience, perceived ease of use, perceived usefulness, attitude and continuance intention to use	The findings showed that perceived convenience, perceived ease of use and perceived usefulness were antecedent factors that affected the acceptance of English mobile learning. Perceived convenience, perceived ease of use and perceived usefulness had a significant positive effect on their attitude. Perceived usefulness and attitude towards use had a significant positive effect on continuance of intention to use.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Terzis, Moridis, Economides and Rebolledo-Mendez (2013)	Computer Based Assessment Acceptance: A Cross-cultural Study in Greece and Mexico	168 students from Greece and Mexico	Perceived playfulness, Perceived usefulness, Perceived ease of use, Computer self efficacy, Goal expectancy, Content, facilitating conditions, behavioral intention and social influence	The results indicated that the Computer Based Assessment Acceptance Model (CBAAM) was valid for both countries. However, there are some cultural differences. Greek students' behavioral intention is triggered mainly by Perceived Playfulness and Perceived Ease of Use, while Mexican students' behavioral intention is caused by Perceived Playfulness and Perceived Usefulness.
Chang and Tung (2008)	An empirical investigation of students' behavioural intentions to use the online learning course websites	212 undergraduate students	Computer self-efficacy, Perceived system quality, Perceived ease of use, Perceived usefulness, Compatibility and intention to use	The findings showed that compatibility, perceived usefulness, perceived ease of use, perceived system quality and computer self-efficacy were important factors for students' behavioural intentions to use the online learning course websites.
Yuena and Ma (2008)	Exploring teacher acceptance of e-learning technology	152 in-service teachers	Subjective norm, computer self-efficacy, perceived usefulness, perceived ease of use, intention	The results found that subjective norm and computer self-efficacy serve as the two significant perception anchors of the fundamental constructs in TAM. However, contrary to previous literature, perceived ease of use became the sole determinant for the prediction of intention to use, while perceived usefulness was not significant in the prediction of intention to use.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Guo and Stevens (2011)	Factors influencing perceived usefulness of wikis for group collaborative learning by first year students	205 students	Attitude towards wikis, Wiki usefulness, Wiki use, student's prior expertise, ease of access,	The findings demonstrated that wiki use influenced by the student's prior expertise. Their perceived usefulness of wikis were strongly influenced by their teachers' attitudes towards the technology as well as the ease of access to the wikis. Attitude towards wikis was largely influenced by the extent to which students saw wikis as a source of help with their assignment work, and their intention to use wikis in the future was driven by their perception of wiki's usefulness.
Amin (2007)	Internet Banking Adoption among Young Intellectuals	250 students	Perceived usefulness, perceived ease of use, perceived credibility and computer self-efficacy and behavioral intention	The results showed that perceived usefulness, ease of use and perceived credibility had a significant relationship with behavioral intention. Moreover, perceived usefulness and ease of use had a significant relationship with computer self-efficacy. However, computer self-efficacy did not associate with perceived credibility. Eventually, perceived ease of use had a significant relationship with perceived usefulness and credibility which shows that these scales are related to perceived ease of use in explaining undergraduate preference.
Zejno and Islam (2012)	Development and validation of library ICT usage scale for the IIUM postgraduate students	285 Postgraduate students	Perceived usefulness, perceived ease of use, computer self-efficacy and use	The findings of the study showed that perceived ease of use, perceived usefulness and computer self-efficacy are significant predictors of postgraduate students' ICT usage.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Usluel, Aşkar and Baş (2008)	A Structural Equation Model for ICT Usage in Higher Education	814 faculty members	ICT facilities (classroom, lab and office), perceived attributes (relative advantages, compatibility, ease of use, observability, traiability), ICT usage (instructional and managerial purposes)	The results revealed that the perceived attributes of ICT and ICT facilities in the universities predict the ICT use. The faculty members use ICT mostly as a means of searching for information about the course through the Internet, and as a means of communication such as: publishing their lecture notes, announcing course assignments, and projects-on WWW.
Devaraj, Fan and Kohli (2002)	Antecedents of B2C Channel Satisfaction and Preference: Validating e-Commerce Metrics	134 consumers	Asset specificity, uncertainty, usefulness, ease of use, time, price savings, empathy, reliability, responsiveness, assurance, satisfaction with electronic commerce channel, channel preference	The findings showed that perceived ease of use and usefulness are important in forming consumer attitudes and satisfaction with the electronic commerce (EC) channel. Ease of use was also found to be a significant determinant of satisfaction. The study also discovered empirical support for the assurance dimension of SERVQUAL as a determinant in EC channel satisfaction. Moreover, the results also indicated general support for consumer satisfaction as a determinant of channel preference.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Wang, Lin and Luarn (2006)	Predicting consumer intention to use mobile service	258 consumers	Self-efficacy, Perceived financial resource, perceived usefulness, ease of use, perceived credibility and intention	The results exhibited that perceived usefulness, perceived ease of use, perceived credibility, self-efficacy and perceived financial resources all had a significant influence on behavioural intention. Furthermore, self-efficacy was found to have a significant effect on perceived ease of use, which, in turn, had a positive effect on both perceived usefulness and perceived credibility. Finally, both perceived financial resource and perceived credibility had a significant effect on perceived usefulness.
Islam (2011b)	Viability of the extended technology acceptance model: an empirical study	285 students	Perceived ease of use, perceived usefulness, computer self-efficacy and Satisfaction	The results indicated that students' perceived ease of use had a statistically significant effect on their satisfaction. The study also discovered that gender did not exert any influence as a moderating variable towards students' satisfaction in using Wireless Internet.
Barkhi, Belanger and Hicks (2008)	A model of the determinants of purchasing From virtual stores	277 students	Actual purchase, Perceived security, Attitude toward online shopping, Perceived usefulness, Perceived peer influence and perceived behavioral control	The findings showed that perceived usefulness, perceived behavioral control, and perceived peer influence attitude towards purchasing from a virtual store. On the other hand, attitude influenced actual purchasing from a virtual store.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Lallmahamood (2007)	An examination of individual's perceived security and privacy of the internet in Malaysia and the influence of this on their intention to use e-commerce: Using an extension of the technology acceptance model	187 students	Perceived usefulness, perceived ease of use, perceived security & privacy and intention to use internet banking	The results demonstrated that perceived security and privacy had a significant impact on perceived usefulness, perceived ease of use and intention to use internet banking, while perceived ease of use influences on perceived usefulness and intention to use. Moreover, perceived usefulness showed a significant impact on intention to use, which is the most important predictor among others.
Rasimah, Ahmad and Zaman (2011)	Evaluation of user acceptance of mixed reality technology	63 students	Personal innovativeness, perceived enjoyment, perceived ease of use, perceived usefulness and intention to use	Results indicated positive correlations between personal innovativeness, perceived enjoyment, perceived ease of use, perceived usefulness and intention to accept mixed reality technology. However, findings from regression analysis suggested that perceived usefulness was the most important predictor in determining users' intention to use this technology in the future.
Kumar and Ravindran (2012)	An empirical study on service quality perceptions and continuance intention in mobile banking context in India	184 customers	Perceived service quality, perceived usefulness, ease of use, perceived credibility, satisfaction, perceived risk and intention	The results discovered that perceived service quality had a significant effect on satisfaction. Perceived risk had an adverse impact on service quality and satisfaction. Intention to use of m-banking was found to be solely dependent on satisfaction. However, perceived ease of use and perceived risk did not exert any significant influence on satisfaction.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Gibson, Harris and Colaric (2008)	Technology Acceptance in an Academic Context: Faculty Acceptance of Online Education	110 faculty members	Perceived ease of use and perceived usefulness	The results showed that TAM was applicable to foster a reasonable explanation of the intentions of physicians in using telemedicine technology. Perceived usefulness was found to have a significant and strong influence on the physicians' intention to use telemedicine technology; however, perceived ease of use provides little additional predictive power beyond that contributed by perceived usefulness of online education technology.
Shittu, Basha, Rahman and Ahmad (2013)	Determinants of social networking software acceptance: A multi-theoretical approach	500 undergraduate students	Perceived usefulness, social identity, compatibility, group norm, observability and acceptance to use social networking	The results indicated that compatibility, group norm and observability positively influenced social networking acceptance. However, perceived usefulness and social identity did not have a significant effect on the acceptance in using social networking.
Aljuaid, Alzahrani and Islam (2014)	Assessing mobile learning readiness in Saudi Arabia higher education: An empirical study.	140 lecturers	Perceived usefulness, perceived ease of use and readiness of mobile learning	The results showed that perceived usefulness and perceived ease of use were significant valid predictors of lecturers' readiness of mobile learning in Saudi Arabian higher education. Moreover, perceived ease of use and usefulness had a significant impact on readiness of mobile learning.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Islam (2014)	Validation of the technology satisfaction model (TSM) developed in Higher Education: The Application of Structural Equation Modeling	285 students	Computer self-efficacy, perceived usefulness, perceived ease of use and satisfaction	The results discovered that perceived ease of use and perceived usefulness had a statistically significant positive direct influence on satisfaction. Besides, computer self-efficacy showed a significant positive direct influence on perceived usefulness and perceived ease of use. In addition, the findings also indicated that computer self-efficacy had a significant indirect influence on satisfaction mediated by perceived usefulness. Finally, computer self-efficacy also exhibited a statistically significant indirect influence on satisfaction mediated by the perceived ease of use of wireless internet.
Wong, Teo and Russo (2012)	Influence of gender and computer teaching efficacy on computer acceptance among Malaysian student teachers: An extended technology acceptance model	302 student-teachers	Computer teaching efficacy, perceived usefulness, perceived ease of use, attitude toward computer use, and behavioural intention	Computer teaching efficacy showed significant effect on perceived usefulness, perceived ease of use and attitude. On the other hand, perceived usefulness had a significant influence on attitude and behavioural intention, while attitude influenced behavioural intention. Finally, perceived ease of use was found to have a significant effect on perceived usefulness.
Shittu, Basha, Rahman and Ahmad (2011)	Investigating students' attitude and intention to use social software in higher institution of learning in Malaysia	151 students	Attitude, Subjective norm, Behavioral intention, Perceived usefulness and Perceived ease of use	The results showed that perceived usefulness, subjective norm, and perceived ease of use had significant effect on the attitude of students towards social software adoption; while attitude was found to be the stronger factor of students' intention to use social software.

Table 2.1, continued

Authors	Titles	Sample	Constructs Measured	Major Findings
Islam, Leng and Singh (2015)	Efficacy of the technology satisfaction model (TSM): An empirical study	180 postgraduate students	Computer self-efficacy, perceived usefulness, perceived ease of use and satisfaction	The findings showed that computer self-efficacy had a statistically significant direct influence on perceived ease of use and perceived usefulness. On the other hand, students' perceived ease of use and perceived usefulness had a statistically significant positive direct influence on their satisfaction in using online research databases. Moreover, computer self-efficacy had a significant indirect influence on satisfaction mediated by perceived ease of use. Finally, computer self-efficacy was also revealed to have a statistically significant indirect influence on satisfaction mediated by perceived usefulness of databases.

2.4 TECHNOLOGY SATISFACTION MODEL (TSM)

The gratification of ICT usage by lecturers, like many cases of technology gratification, may be understood from the perspective of the Technology Satisfaction Model (TSM). The TSM, proposed by Islam (2014) is developed and validated by incorporating two additional intrinsic motivation attributes, namely, computer self-efficacy and satisfaction into the original Technology Acceptance Model (Davis et al., 1989). The TSM posits that three factors influence technology satisfaction, the first being users' perception of the benefits derived from using the technology (Perceived Usefulness or PU), the second, how easy they perceive the use of technology (Perceived Ease of Use or PEU) and the third, technology requires a considerable degree of computer self-efficacy (CSE) to perform effective searches. These factors then determine users' satisfaction in using the technology in higher education. The TSM contains one exogenous variable (CSE), two mediated variables (PEU, PU) and one endogenous variable (SAT), which are shown in Figure 2.2.

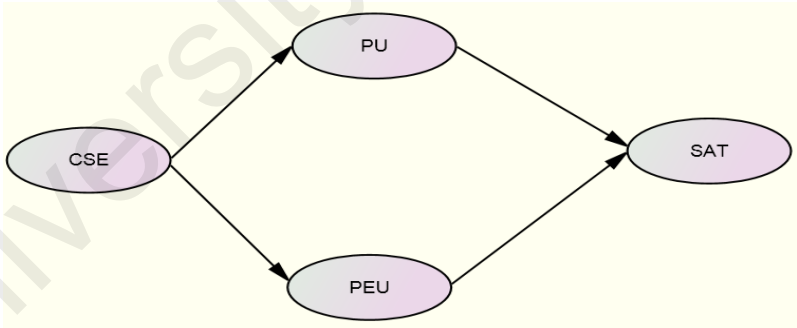

Figure 2.2: Technology Satisfaction Model (TSM) (Islam, 2014)

The initial TSM was applied to assess the satisfaction on wireless internet usage with a particular focus to the students studying in Higher Education. However, TSM ignored the issues of two extrinsic motivation components, namely, intention to use and actual use, even though they are important constructs in measuring users' technology acceptance or adoption. The findings of the study have in many ways

contributed to the body of knowledge on the Technology Satisfaction Model (TSM). In addition, the findings of TSM indicated that perceived ease of use and perceived usefulness had a statistically significant positive direct influence on satisfaction. Subsequently, computer self-efficacy was found to have a significant positive direct influence on perceived usefulness and perceived ease of use. Moreover, the results also demonstrated that computer self-efficacy had a significant indirect influence on satisfaction mediated by perceived usefulness. Eventually, computer self-efficacy was also revealed to have a statistically significant indirect influence on satisfaction mediated by perceived ease of use of wireless internet. However, Islam (2014) recommended that the usage of internet and the users hold a global pattern; thus this model has a great potential to work globally regardless of geographical, economical, social and cultural patterns in a particular country or region. As such, this study included TSM as one of the theoretical frameworks to develop and validate the Technology Adoption and Gratification (TAG) model to assess lecturers' ICT usage in higher education.

On the other hand, Lee and Park (2008) examined the relationship between the mandatory adoption of mobile technology and market performance in the business-to-business (B2B) setting. They presented and validated the B2B technology satisfaction model, adding perceived loss of control with satisfaction and two extrinsic motivation components of TAM, namely, perceived usefulness and perceived ease of use (Davis, 1989). However, they ignored the issue of computer self-efficacy even though this was demonstrated to be the most significant predictor of TSM developed and validated by Islam (2014). The proposed B2B technology satisfaction model showed that the construct of user satisfaction was a mediator variable, while perceived market performance was an endogenous variable. In this case, it would be better to have user

satisfaction as an endogenous variable to claim or generalize the B2B TSM. The findings demonstrated that perceived usefulness had a significant direct effect on user satisfaction and perceived market performance. Subsequently, perceived ease of use has a significant direct effect on user satisfaction. However, Lee and Park (2008) did not assess the indirect relationships between the latent variables. User satisfaction was represented by only two valid items which was not sufficient for measuring or validating the B2B TSM. In other related studies, Adamson and Shine (2003) regarded perceived ease of use as a marginal influencer of the end user satisfaction in a mandatory environment of a Bank treasury. Their findings suggested that computer self-efficacy and user satisfaction played an important role in new technology acceptance, thus the two constructs require more thought when designing information systems in mandatory environments. Along this line, Al-Jabri and Roztocki (2010) proposed a conceptual mandatory information technology implementation framework. It included the TAM with user satisfaction and explained based on literature review, the complexity of issues of technology adoption and use, especially in mandatory settings. However, there is no validation to their proposed framework with empirical data to examine the causal relationships among the constructs. Shipps and Phillips (2013) found that concentration and perceived interactivity influenced an end user's satisfaction with a social network along with antecedents from the TAM. The structural model indicated that perceived usefulness poorly influenced satisfaction ($\beta = .16$).

2.5 ONLINE DATABASE ADOPTION AND SATISFACTION (ODAS) MODEL

Islam (2011a) developed and validated the Online Database Adoption and Satisfaction (ODAS) Model by consisting of the constructs computer self-efficacy and satisfaction into the TAM (Davis, 1989). The ODAS model containing three exogenous variables (perceived ease of use, perceived usefulness and computer self-efficacy), one mediated variable (intention to use) and one endogenous variable (satisfaction) as shown in Figure 2.3. The findings revealed significant influences of perceived usefulness and computer self-efficacy on postgraduate students' intention to use the database and their satisfaction in using it. In addition, perceived ease of use and intention to use were found to have a significant direct influence on satisfaction. The findings contributed to a better understanding of the TAM and technology adoption among postgraduate students. Moreover, the ODAS Model (Islam, 2011a) also demonstrated that perceived ease of use found to be most significant predictor compared to the behavioural intention influence on the students' satisfaction in using the online database. Besides this, the results of ODAS model discovered that the two exogenous variables (PU and CSE) explained almost 53% of the variance intention to use, and the three exogenous variables (PEU, PU and CSE) and one mediated (INT) variable together explained approximately 61% of the variability of the students' satisfaction and adoption in using the online database. However, ODAS model also ignored the issue of an extrinsic motivation attribute, namely, actual use, which is a vital factor in assessing users' technology adoption.

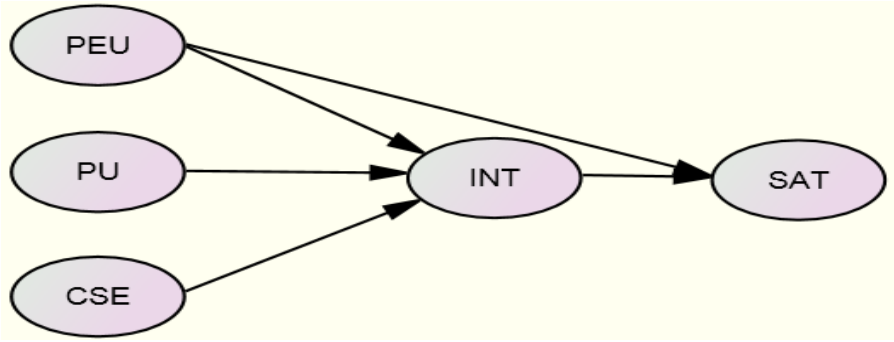

Figure 2.3: Online Database Adoption and Satisfaction (ODAS) Model (Islam, 2011a)

In a recent study, Ahmad et al., (2010) demonstrate that computer self-efficacy influences technology use. In fact, the influence of this construct is evident in many cases involving the employment of computer technology (Ball & Levy, 2008; Charalambous & Papaioannou, 2010; Kenzie, Delecourt & Power, 1994; Moos & Azevedo, 2009). Eastin and LaRose (2000) studied computer self-efficacy in the context of Internet use among experienced and novice users, and concluded that it is a determining factor in closing the digital divide between the two groups of users. Moreover, TSM (Islam, 2014) and ODAS model (Islam, 2011a) also explored that computer self-efficacy was the most important construct in measuring students' technology satisfaction and adoption in higher education. Based on this observation and taking into account that the universities ICT facilities entail a considerable degree of computer self-efficacy to perform effective usage, therefore this study proposed the inclusion of computer self-efficacy (CSE) as an important predictor of lecturers' adoption and gratification of ICT facilities for their teaching and research.

Lecturers' intention to use and actual use of the ICT are more likely to persist if they are satisfied with the resources and facilities provided therein, and if their educational or research needs are met. Togia and Tsigilis (2009) found satisfaction to be one of the barriers hampering graduate students' utilization of the electronic resources made available to them. While TSM discovered that students' satisfaction

was influenced computer self-efficacy, perceived usefulness and perceived ease of use of wireless internet in higher education (Islam, 2014). Along this line, ODAS model also found that satisfaction was determined by intention to use, computer self-efficacy, perceived usefulness and perceived ease of use (Islam, 2011a). Based on this observation, the present study included gratification (GRAT) as an endogenous variable explaining ICT facilities gratification among the universities lecturers. This study predicted that gratification would also directly and indirectly be affected by the ICT's ease of use, usefulness, computer self-efficacy, intention to use and actual use. Therefore, in the study's hypothesized model as shown in Figure 2.4, two other intrinsic motivation attributes – gratification and computer self-efficacy – were taken from TSM and ODAS model and incorporated into the original TAM to develop and validate the Technology Adoption and Gratification (TAG) model to examine lecturers' adoption of and gratification in using the universities ICT facilities.

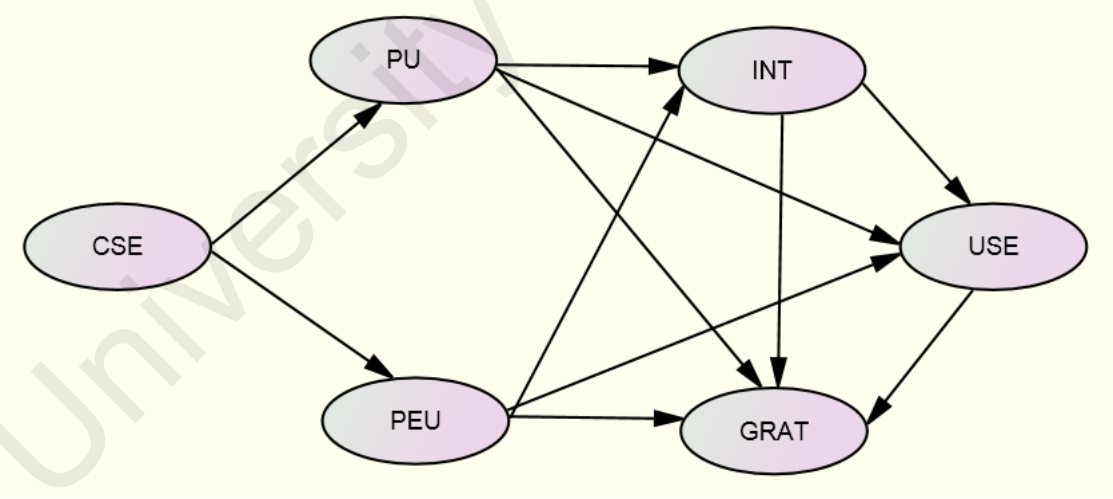

Figure 2.4: The Hypothesized Technology Adoption and Gratification (TAG) Model

2.6 CONSTRUCTION OF HYPOTHESES

In this section, this study provided a concise but relevant literature review pertaining to the constructs impacting lecturers' utilization of ICT facilities, as well as the use of the TAM, TSM and ODAS model in predicting technology adoption and gratification. Based on the review, the study proposed eleven hypotheses to develop and validate the TAG model and elucidated the dimensions influencing lecturers' adoption and gratification of ICT facilities provided by the universities. These hypotheses clarified the causal relationships among all the constructs under study: computer self-efficacy, perceived usefulness, perceived ease of use, intention to use, actual use and gratification in using ICT facilities in higher education.

According to Bandura and Schunk (1981), self-efficacy is defined as one's judgments about how well one can perform various courses of actions in different prospective situations fraught with many unpredictable and stressful elements. This definition was echoed by Aiken (1993), who opined that self-efficacy stands for a person's expectation of his/her capability in learning or performing certain behaviours that will translate into desirable outcomes in a particular situation. In the learning process, it conveys students' judgments about their cognitive capabilities to accomplish a specific academic task or particular goals (Schunk, 1991). In the context of Internet use, it denotes a user's belief in his/her capabilities to organize and execute courses of Internet actions required to produce given attainments. This, Eastin and LaRose (2000) asserts, is a determining factor in efforts to close the digital divide between the experienced Internet users and the novices.

Research confirms propositions that self-efficacy influences the choice as to whether or not to engage in a task, the effort made in performing it, and the level of persistence required in accomplishing it (Bandura, 1977; Bandura & Schunk, 1981;

Delcourt & Kinzie, 1993). It influences how people feel, think, and behave (Bandura, 1986: 393). According to Ahmad et al., (2010, p. 271), the inclusion of self-efficacy as an intrinsic motivation construct offers 'deeper and richer understanding of why and how the technology is used'.

In their study, Compeau and Higgins (1995) empirically tested a 10-item measure of computer self-efficacy (CSE) and found a significant relationship between CSE and outcome expectations and use. In a further empirical validation of the CSE instrument developed in this study, Compeau, Higgins, and Huff (1999) reaffirmed the evidence that CSE influences an individual's behavioral orientations to adopt an information system.

The findings of TSM (Islam, 2014) discovered that computer self-efficacy is the most important predictor in measuring the students' satisfaction in using wireless internet for their learning purposes. Moreover, TSM also showed that computer self-efficacy revealed a significant positive direct influence on perceived usefulness in using wireless internet. On the other hand, Ahmad et al., (2010) indicated that computer self-efficacy indirectly influences faculty's use of computer mediated technology through perceived usefulness and intention to use. Subsequently, Islam (2011a) revealed the presence of significant indirect relationship between computer self-efficacy and satisfaction through the mediating influence of intention to use online research database. Along this line, in his book entitled "Online Database Adoption and Satisfaction Model", Islam, (2011a) also discovered the significant interrelationships among the exogenous variables were measured in the revised structural model, and it was found that the interrelationships between computer self-efficacy, perceived ease of use and perceived usefulness were statistically significant. Similarly, Islam (2011b) also demonstrated significant positive interrelationships

between computer self-efficacy, perceived ease of use and perceived usefulness. YouTube users' self-efficacy showed a significant effect on perceived usefulness (Lee & Lehto, 2013). Stone and Baker-Eveleth (2013) hypothesized that a mid-sized university students' self-efficacy regarding the use of an e-textbook significantly influences outcome expectancy/usefulness regarding e-textbooks. However, their findings showed that it did not exert statistically significant effect on outcome expectancy/usefulness in purchasing electronic textbooks. In a previous study, pre-service teachers' self-efficacy levels regarding ICT usage in education were found to be moderate. Thus, teachers' self-efficacy or self-confidence concerning ICT usage must be high in order for them to be highly encouraged users of ICT, which in turn would lead to flourishing ICT technology integration (Tezci, 2011). Amin (2007) confirmed that university students' computer self-efficacy of internet banking had a significant effect on their perceived usefulness, while it was not related with perceived credibility of internet banking system. Zejno and Islam (2012) demonstrated that computer self-efficacy is one of the significant predictors of postgraduate students' ICT usage in higher education. In a related study, Wong et al., (2012) revealed that computer teaching efficacy had a significant effect on perceived usefulness (β=.22, $p<.00$), perceived ease of use (β=.48, $p<.00$) and attitude toward computer use (β=.38, $p<.00$). However, the findings also showed that computer teaching efficacy moderately effects on usefulness compare to other constructs.

On the other hand, according to Islam (2014), computer self-efficacy had a significant positive direct influence on perceived ease of use of wireless internet. Islam (2011a & 2011b) also exhibited significant interrelationships between computer self-efficacy and perceived ease of use. Terzis et al., (2013) predicted that Greek and Mexican university students' computer self-efficacy will have a positive influence on

their Perceived Ease of Use. Their findings were consistent with the prediction. The significant influence of Greek and Mexican university students' computer self-efficacy shows that a student who recognizes how to use computers, perhaps he/she will find easy to use a Computer Based Assessment that needs fundamental information technology skills. Amin (2007) found that university students' computer self-efficacy had a positive effect on their perceived ease of use of the Internet banking systems. In a study involving university students' use of an information system, Agarwal and Karahanna (2000) discovered CSE to be a key antecedent of PEU, while Wu et al., (2008) found a statistically significant relationship between teachers' CSE and their intention to use ICT in teaching. In light of such findings, it is important to assess lecturers' beliefs about their computer ability and the extent to which it impacts their decision to adopt technology. Besides this, Islam et al., (2015) revealed that postgraduate students' computer self-efficacy had a statistically significant direct influence on perceived ease of use and perceived usefulness in using online research databases in higher education. These observations led to hypothesize that in the study:

H1: Computer self-efficacy (CSE) will have a positive direct influence on lecturers' perceived ease of use (PEU) and perceived usefulness (PU) of ICT facilities in higher education.

In addition to perceived benefits, another important influencer is how easy lecturers find the ICT facilities to use. In the original TAM, perceived ease of use means the extent to which the user believes the use of technology will be free of effort (Davis et al., 1989). Prior studies have found a significant influence of PEU on users' intention to use computer-based systems (Chau, 1996; Davis et al. 1989; Karahanna & Straub, 1999; Venkatesh & Davis, 1996, 2000; Venkatesh & Morris, 2000). However,

PEU has been found to be less influential and reliable (Ma & Liu, 2004; Wu *et al.,* 2008; Huang, 2008). Tenopir (2003), specifically, discovered that ease of use was a major factor influencing her respondents' adoption of the online database. Outside the educational context, Lee, Fiore and Kim (2006) demonstrated that PEU significantly enhanced consumer attitude and behavioral intention towards an online retailer, while Ramayah and Lo (2007) revealed a significant effect of PEU on intention to use an electronic resource planning system. Moreover, Lee and Lehto (2013) hypothesized that perceived ease of use will have a significant effect on YouTube users' behavioral intention. Nevertheless, the results of their study showed that perceived ease of use did not indicate significant effect on either behavioral intention or perceived usefulness of YouTube. Similarly, Islam (2011a) also predicted that perceived ease of use will have a positive direct influence on postgraduate students' intention to use the online research databases. However, the finding of his study revealed that perceived ease of use had a significant direct effect on postgraduate students' intention to use of online research databases, but in an adverse direction ($\beta = -.31$, $p < .005$).

In addition, Hanafizadeh et al., (2014) found out that bank clients' perceived ease of use had significant influence on intention to use mobile banking. Subsequently, Gultekin (2011) discovered that the effects of perceived ease of use on police officers' intention to use the POLNET system were statistically significant. Meanwhile, Stone and Baker-Eveleth (2013) confirmed that perceived ease of e-textbook use positively influences behavioral intentions to purchase an e-textbook, while Martínez-Torres et al., (2008) discovered that perceived ease of use, despite indicating a slightly weaker influence compared to perceived usefulness on behavioural intention to use e-learning tools. In other study, Shroff et al., (2011) confirmed that students' perceived ease of use had a significant influence on attitude towards usage of portfolio system.

Consequently, perceived ease of use had the strongest significant influence on perceived usefulness. Along this line, Chang et al., (2012) demonstrated that perceived ease of use was antecedent factor that affected intention to accept of English mobile learning. Terzis et al., (2013) found that the students' perceived ease of use had a significant effect on intention to use computer based assessment in higher education.

On the other hand, the Online Database Adoption and Satisfaction Model (Islam, 2011) revealed that perceived ease of use found to be more significant predictor compared to the behavioural intention influence on the students' satisfaction in using the online research databases. According to Langeard, Bateson, Lovelock, and Eiglier (1981), the study discovered that, customers consider effort expended in utilizing service delivery to be more relevant in choosing between available service delivery options, the greater the service delivery, the more the consumer satisfaction (Churchill & Suprenant, 1982). Szymanski & Hise (2000) and Dabholkar & Bagozzi (2002) respectively revealed that, convenience and ease of use are important antecedents of e-satisfaction. In a related study, Shamdasani et al. (2008) regarded ease of use as one of the factors of service quality and investigated its impact on consumer satisfaction in using self-service internet technologies. Along this line, Huang (2008) indicates that, the impact of e-consumers' perceived ease of use mediated by their behavioral attitude on their satisfaction are statistically significant. The TSM confirmed that perceived ease of use demonstrated a significant direct effect on students' satisfaction in using wireless internet (Islam, 2014). Meanwhile, Islam (2011b) also represented that perceived ease of use had a statistically significant effect on students' satisfaction in using wireless internet technology in higher education. Furthermore, Lee and Park (2008) discovered that perceived ease of use had a

significant effect on user satisfaction in using mobile technology. On the other hand, the significance of perceived ease of use in predicting technology adoption is highly emphasized in the TAM (Davis et al., 1989). In addition, Devaraj et al. (2002) discovered that perceived ease of use was found to be a significant determinant of satisfaction in transaction cost analysis as well as important component of TAM in forming consumer attitude and satisfaction with the electronic commerce channel, while Islam et al., (2015) confirmed that perceived ease of use had a significant effect on students' satisfaction in using online research database in higher education. These observations led to next hypothesis, which reads as follows:

*H*2: Perceived ease of use (PEU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.

In the TAM, perceived usefulness is defined as the extent to which an individual believes that using the technology will enhance his or her performance (Davis 1989). PU has also been conceived as the benefits and advantages derived from using a technology. The impact of PU on users' intention to use (INT) various types of computer-based and Internet-based systems has been comprehensively documented in numerous studies (Ahmad et al. 2010; Davis, 1993; Guriting & Ndubisi, 2006; Mathwick, Rigdon & Malhotra, 2001; Ramayah & Lo, 2007). Convenience of access, in particular, has been frequently cited as a major advantage by users of electronic journals in multiple studies (Maughan, 1999; Tenner & Yang, 1999; Hiller, 2002). In Liew, Li, Foo and Chennupati (2000), the benefits of electronic resources were found to be the facility to link to additional information, the ability to browse, and the currency of materials. Other benefits and advantages include robust search capabilities, hyperlinks to outside content, efficient acquisition of information (Dillon & Hahn,

2002; Ray & Day, 1998), time saving factor, and print and save capabilities (Togia & Tsigilis, 2009). These benefits and advantages were realized all the more by students when their learning and academic pursuits became greatly enhanced. Wu et al., (2008) corroborated these findings on the impact of PU by noting that it is a significant determinant of science teachers' intention to integrate technology into their instruction. In recent studies have also explored a significant effect of perceived usefulness on users' intention to use mobile learning (Hanafizadeh et al., 2014; Chang et al., 2012), POLNET system (Gultekin, 2011), e-learning tools (Martínez-Torres et al., 2008) and e-portfolio system (Shroff et al., 2011), while Terzis et al., (2013) discovered that perceived usefulness showed a significant influence on students' intention to use computer based assessment in higher education.

The TSM (Islam, 2014) showed that perceived usefulness had a statistically significant positive direct influence on satisfaction in using wireless internet in higher education. Regarding the Online Database Adoption and Satisfaction Model, Islam, (2011a) discovered that, perceived usefulness has a statistically significant indirect influence on satisfaction mediated by intention to use online database, while Islam et al., (2015) found that perceived usefulness was the most significant factor of TSM in effecting postgraduate students' satisfaction in using online research database in higher education. Besides this, Lee and Park (2008) found that perceived usefulness had a significant effect on user satisfaction, a surrogate of information system success. Similarly, Islam (2011b) hypothesized that perceived usefulness positively influences students' satisfaction in their acceptance of wireless technology. Even though, the results indicated the low path coefficients of 0.19 between perceived usefulness and satisfaction. In addition to this, in the extant literature, numerous studies exist vis-à-vis the effect of perceived usefulness on consumer satisfaction (Anderson, Fornell, &

Lehmann, 1994). According to Huang (2008), perceived usefulness was found to have an impact on consumer satisfaction mediated by their behavioral attitudes. On the other hand, Clemons and Woodruff (1992) reported that, perceived value might directly lead to the formation of overall feelings of satisfaction. This argument is corroborated by McDougall and Levesque (2000) who indicated that, perceived value is a significant driver of customer satisfaction. Devaraj et al., (2002) revealed that perceived usefulness was an essential factor in forming consumer attitude and satisfaction with the electronic commerce channel. Against this backdrop, It is thus hypothesized that:

H3: Perceived usefulness (PU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.

H9: Perceived ease of use (PEU) and Perceived usefulness (PU) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by intention to use (INT), respectively.

The result of ODAS model (Islam, 2011a) depicted that intention to use had a positive direct effect on students' satisfaction in using online research databases in higher education. From various prior studies performed on the relationship between CSE and behavioural intention to use technology or infusion (Wu *et al.,* 2008; Ahmad *et al.,* 2010) and the latter with individual satisfaction (Huang, 2008; Shamdasani *et al.,* 2008), it is inferred that there is a relationship between intention to use and satisfaction. Against this backdrop, one purpose of this study was to develop and validate the TAG model by incorporating computer self-efficacy and gratification as two attributes to examine lecturers' adoption and gratification in using ICT facilities. The presented study assessed the direct effects of intention to use on lecturers' actual

use and gratification in using the ICT facilities for their teaching and research purposes, and hypothesized that:

H4: Intention to use (INT) will have a positive direct influence on lecturers' gratification (GRAT) and actual use (USE) of ICT facilities in higher education.

H5: Use (USE) will have a positive direct influence on gratification (GRAT) in using ICT facilities.

H10: Intention to use (INT) will have a positive indirect influence on lecturers' gratification (GRAT) mediated by actual use (USE) of ICT facilities in higher education.

Havelka's (2003) study perceived significant differences in CSE among students in different areas of academic discipline. In light of such findings, it is imperative on the part of the researchers to assess students' self-beliefs about their academic capabilities as well as the acknowledgement of this aspect as being instrumental on their motivation and academic achievement (Pajares, 2002). Besides, Wu *et al.* (2008) found a statistically significant relationship between CSE and intention to infuse Information Technology, although Stone and Baker-Eveleth (2013) indicated that computer self-efficacy positively influenced students' attitudes regarding purchasing e-textbooks. Alenezi et al., (2010) confirmed that computer self-efficacy was significantly influence the students' intention to use e-learning, while Ahmad et al., (2010) hypothesized that computer self efficacy indirectly effects faculty's use of the computer mediated technology medicated by perceived usefulness and intention to use. Their findings concluded that computer self efficacy was moderately more influential than did the behavioural intention in influencing the faculty's use of computer technology. According to Chang and Tung (2008), self-efficacy was an important factor for university students' behavioural intention to use

the online learning course websites. Similarly, Zejno and Islam (2012) claimed that computer self-efficacy is one of the significant predictors of postgraduate students' ICT usage.

In addition, Islam (2014) demonstrated that computer self-efficacy is the most significant construct of the TSM and it also exerted indirect significant influence on satisfaction mediated by perceived ease of use and perceived usefulness, respectively. The effect of computer self-efficacy on perceived usefulness, ease of use and satisfaction were limited to their capabilities and requisite skills in using wireless internet facility and online research databases, saving and printing journals or articles, and accessing the database from the university website. However, students described obstacles related to accessing journals from the online database. In other studies, computer self-efficacy showed a significant indirect effect on students' satisfaction mediated by intention to use the online database (Islam, 2011a, p. 50). On the other hand, Islam (2011b) hypothesized that computer self-efficacy positively influences students' satisfaction in accepting wireless technology. However, it did not depict the direct impact on satisfaction; while it might be reflected through the significant interrelationships among the exogenous variables, namely, perceived ease of use and perceived usefulness. At the same time, Islam et al., (2015) discovered that students' computer self-efficacy had a significant indirect influence on satisfaction mediated by perceived ease of use and perceived usefulness of research databases. In other studies, Ahmad et al., (2010), Gong, Xu and Yu (2004), Hu, Clark and Ma (2003) and Ellen, Bearden and Sharma (1991) demonstrate that computer self-efficacy influences technology acceptance and use. In fact, the influence of this construct is evident in many cases involving the employment of computer technology (Ball & Levy, 2008; Charalambous & Papaioannou, 2010; Kenzie, Delecourt & Power, 1994; Moos &

Azevedo, 2009). Eastin and LaRose (2000) studied computer self-efficacy in the context of Internet use among experienced and novice users, and concluded that it is a determining factor in closing the digital divide between the two groups of users. It is therefore hypothesized that:

*H*6: Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' intention to use (INT) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.

H7: Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.

*H*8: Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' use (USE) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.

2.6.1 CROSS-CULTURAL STUDIES

Terzis et al., (2013) stated that the necessity to comprehend the individual acceptance drives numerous researchers to a cross cultural analysis concerning acceptance. Many prior studies included a cross-cultural factor by comparing the efficacy of an acceptance model such as TAM or by comprising constructs that were distinguishing the cultures. However, earlier cross-cultural researches exhibited that acceptance or adoption models such as TAM were affected by culture. As such, they examined university students' acceptance of Computer Based Assessment (CBA) Systems by applying Computer Based Assessment Acceptance Model (CBAAM) in the two diverse cultures of Greece and Mexico. The CBAAM was integrated by nine factors, namely, perceived playfulness, perceived usefulness, perceived ease of use, computer

self-efficacy, social influence, facilitating conditions, goal expectancy, content and behavioral intention. To validate the model, a total of 168 students were selected from two universities in Greece and Mexico. They consisted of 117 first-year Greek and 51 first-year Mexican students. The CBAAM was estimated using partial least squares (PLS) to test fifteen hypotheses in a cross cultural setting. The findings of their study demonstrated that the CBAAM was valid for both countries in general. Nevertheless, there were some distinctions due to the culture. Greek students' behavioral intention was primarily influenced by perceived ease of use and perceived playfulness, although Mexican students' behavioral intention was affected by perceived usefulness and perceived playfulness. However, these results may not be generalized due to the small sample size. Besides this, this study was limited between two universities in Greece and Mexico. They suggested that the findings of this study could be useful for researchers, developers and educators and they should take them into contemplation for future, especially researches interest in cultural dimensions and their influences in education.

Teo, Luan and Sing (2008) conducted a cross-cultural study to investigate the pre-service teachers' intention to use technology in Singapore and Malaysia applying the Technology Acceptance Model (TAM). However, so far, there was no cross-cultural research to assess pre-service teachers' acceptance by applying TAM in Singapore and Malaysia so that it would be of interest to the research community to observe if the TAM could be validated in the diverse culture. The data for their study were gathered through an online survey questionnaire. The pre-service teachers for their study consisted of 250 and 245 in Singapore and Malaysia, respectively. They proposed research model based on TAM for this study which included the four factors, (a) perceived ease of use, (b) perceived usefulness, (c) computer attitude, and (c)

behavioral intention control, influence the future intentions to use computer in the different culture. The Structural Equation Modeling (SEM) was used to validate the model. The results of their study revealed that there were significant dissimilarities between Malaysian and Singaporean pre-service teachers in terms of their computer attitude, perceived ease of use and perceived usefulness of technology. However, no differences were identified in behavioral intention among these two countries with regards to technology acceptance. They recommended that the SEM could be applied to assess structural invariance of the TAM to examine of its validity in the cross-culture. In addition, future study also can extend TAM by including additional variables of interest to the education community.

According to Singh, Fassott, Chao and Hoffmann (2006), the technology acceptance model (TAM) has been one of the most influential models in the information technology literature. However, TAM has not been applied in the marketing literature to comprehend user acceptance of international web sites. In so doing, they extended the TAM by incorporating cultural adaptation factor to measure international students' acceptance and usage of multinational company web sites in the different cultures in German, Brazil and Taiwan. They also asserted that one of the causes they preferred to collect data from Brazil, Germany, and Taiwan that the findings were more comparable and meaningful in the different culture. Data were collected from 40 Brazilian, 110 German, and 100 Taiwanese online consumers. However, the total sample size seems to be inadequate in order to generalize the findings of their study. To evaluate the extended TAM and its causal relationships between the constructs, the partial least squares (PLS) were applied. The result of their study discovered that the causal relationships between the extended TAM factors, namely, perceived ease of use, perceived usefulness, cultural adaptation, attitude and

behavioral intention to use international websites were presented strong evidence for the viability of TAM in elucidating web site usage in Brazil, Germany, and Taiwan. The findings also showed that the total influence of consumers' perceived usefulness was greater than that of perceived ease of use PEOU on intention to purchase, while perceived usefulness had a greater effect on students' attitude toward the website in comparison to perceived ease of use. Furthermore, cultural adaptation was found to be an important exogenous variable for the three diverse cultures in Brazil, Germany, and Taiwan in using international web site. These three countries students' attitude toward using the web site was demonstrated to have a strong influence on their intention to purchase from the international web sites. They suggested based on their findings that future researchers may apply TAM to examine numerous forms of technology usage and in diverse contexts to discover its validity and frontier surroundings.

On the one hand, Al-Gahtani, Hubona and Wang (2007) investigated a study of Culture and the acceptance and use of information technology (IT) in Saudi Arabia. Using a survey of 722 knowledge workers those who were utilizing desktop computer applications on a voluntary basis in Saudi Arabia, they applied a modified unified theory of acceptance and use of technology (UTAUT) to measure users' acceptance and use of IT. Their findings confirmed that the UTAUT model explained 39.1% of intention to use, and 42.1% of usage of the total variance. Besides this, applying on the theory of cultural dimensions, they examined the similarities and dissimilarities between the Saudi Arabia and North American validations of UTAUT with regards of cultural diversities that influenced the users' acceptance of IT in these two societies.

Straub, Keil and Brenner (1997) estimated the technology acceptance model (TAM) through comparison among three different countries: United States; Japan; and Switzerland. The data for their study were collected from 99 American, 142 Japanese,

and 152 Swiss employees of three different airlines. Their results indicated that TAM was influenced by the different cultures. Additionally, TAM model was significant and explained around 10% of the variance in usage and adoption observed in both the U.S. and Swiss respondents, it was not significant for the Japanese. However, the total sample size may not be adequate in order to generalize their findings.

Huang, Ming-te, and Wong (2003) asserted that the culture of People's Republic of China (PRC) typically varies from that of North America, and is a typical transitional economy at the accepting end of information technology transfer. Thus, the cross-cultural validity of technology acceptance models may not be justified without an assessment on the applicability of technology acceptance in the context of the PRC, whereas acceptance models were explored in North America. As a result, they conducted a study of assessing of the cross-cultural applicability of technology acceptance model (TAM) as evident from China. The data for their study were collected from 121 employees in Guangzhou, China. The results confirmed that the TAM was applicable across cultures. The finding provides evidence on the applicability of Technology Acceptance Model (TAM) across cultures. Therefore, the validity of TAM was expanded by assessing technology acceptance beliefs in a developing country with Chinese culture. They believed that with a broad comprehending of cross-cultural technology adoption process and outcome, organizations would be in a better position to utilize the usefulness of the new communication media, particularly in culturally different non-western economies that are at the accepting end of technology transfer. They recommended that many studies need to be conducted in diverse countries or cultures in order to generalize the validity and applicability of TAM.

In a recent cross-cultural study, Chong, Chan and Ooi (2012) extended the technology acceptance model (TAM) and diffusion of innovation (DOI) theory by adding more constructs, namely, trust, cost, social influence, variety of services, and control variables such as age, educational level, and gender of consumers to develop their conceptual model for this study. The model was validated to predict consumers' intention to adopt mobile commerce in China and Malaysia. To develop and validate their model, data obtained through a survey conducted with 172 Malaysian and 222 Chinese consumers, and the model was evaluated using hierarchical regression analysis to test fourteen hypotheses. The findings of their research model demonstrated that the factors in TAM and DOI models were not competent to predict consumer decisions to adopt mobile commerce. However, constructs such as trust, cost, social influence, and variety of services had a significant influence on consumers' intention to adopt mobile commerce. The results also showed that consumers' decision to adopt mobile commerce was affected by the different cultures. They suggested that future studies can incorporate additional adoption dimensions, namely, self efficacy and perceived enjoyment into the research models, although their study ignored them. These observations led this study to hypothesize that:

*H*11: There will be a cross-cultural invariant of the causal structure of the TAG model between Malaysian and Chinese lecturers.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The broad objective of this study was to develop and validate the technology adoption and gratification (TAG) model to evaluate lecturers' ICT usage in higher education. The factors that influenced lecturers' adoption and gratification of the ICT facilities were hypothesized to be the ICT's ease of use, usefulness, computer self-efficacy, actual use and gratification from the usage of this service.

This study also applied the method of Rasch model to develop and validate the psychometric properties of lecturers' ICT usage and Structural Equation Modeling (SEM) to examine the causal relationships among the various exogenous, endogenous and mediated constructs of TAG model. Subsequently, this chapter provides detailed descriptions of the population and sample, sampling procedure, research instrument, and data analysis procedures, structural equation modeling, and model evaluation.

3.2 POPULATION AND SAMPLE

The present study was conducted at two public universities, namely, University of Malaya in Malaysia and Jiaxing University in China. As such, the target population of this study was different from each other and the total sample size of this study was 400 academic staff, which was equally divided for both universities. The total population of this study comprised all the academic staff of the University of Malaya and Jiaxing University. The total sample size was recommended by Hair, Black, Babin, and Anderson (2010). According to Hair et al., (2010), "the smallest sample size is to have at least five times as many observations (respondents) as the number of

variables (items) to be analyzed". The meaning is that each item in the questionnaire should have minimum five respondents. In this case, the total number of items has to be multiplied by five to compute the total sample size whereas the questionnaire of the present study was containing almost eighty items to develop and validate the technology adoption and gratification (TAG) Model to assess lecturers' ICT usage. Approximately 1965 lecturers were taken as the sampling frame; out of this, a total of 200 lecturers from thirteen faculties of the University of Malaya (Arts and Social Sciences, Built Environment, Business and Accountancy, Computer Science and Information Technology, Dentistry, Economics and Administration, Education, Engineering, Language and Linguistics, Law, Medicine, Sciences and Academy of Islamic Studies) were selected using stratified random sampling procedure. Meanwhile, the target population of Jiaxing University was approximately 811 lecturers included as the sampling frame; out of this, a total of 200 lecturers from seven colleges (Foreign Language Studies, Mathematics and Engineering, Biology and Chemistry, Material Engineering, Education, Civil Engineering & Architecture and Jiaxing University Nanhu) were collected applying stratified random sampling procedure.

3.2.1 LECTURERS' DEMOGRAPHIC INFORMATION IN THE UNIVERSITY OF MALAYA

The 200 participants were lecturers from all the faculties of the University of Malaya. They consisted of 47% male and 53% female. The gender breakdown is shown in Figure 3.1.

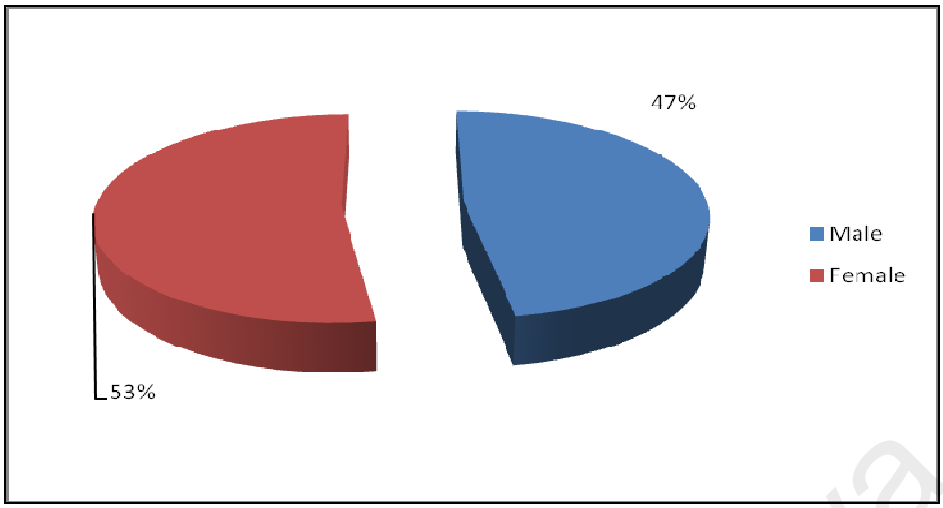

Figure 3.1: Sample of Study According to Gender

The 200 participants were lecturers from thirteen faculties of the University of Malaya, namely, Arts and Social Sciences (FASS), Built Environment (FBE), Business and Accountancy (FBA), Computer Science and Information Technology (FCSIT), Dentistry (FD), Economics and Administration (FEA), Education (FEDU), Engineering (FE), Language and Linguistics (FLL), Law (FL), Medicine (FM), Sciences (FS) and Academy of Islamic Studies (AIS). The sample breakdown according to faculties is shown in Figure 3.2.

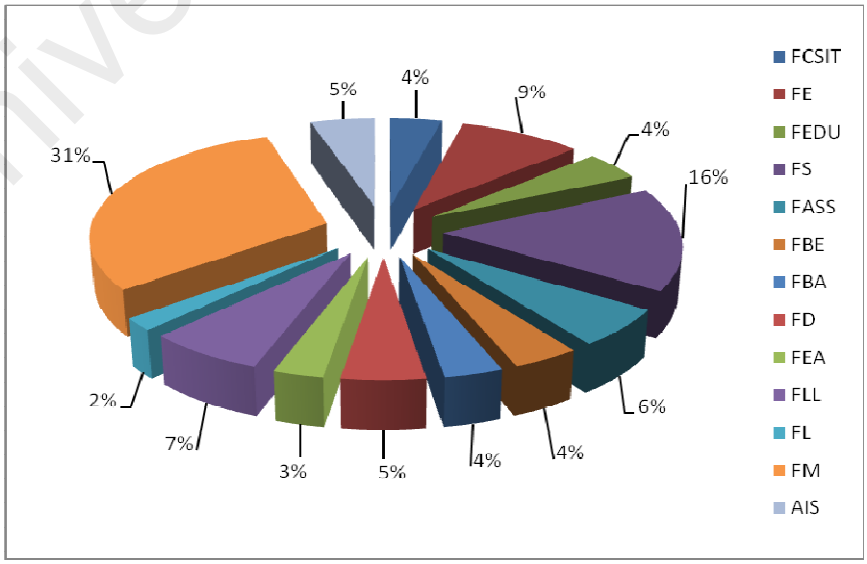

Figure 3.2: Sample of Study According to Faculties

The sample consisted of lecturer's educational background. They were holding the different levels of educational background such as undergraduate (UG), Master and PhD and working in various faculties of the University of Malaya. The majority of the lecturers were holding PhD degree (74%) whereas only 25% lecturers were Master degree holders and the remaining 1% was undergraduate holders. The breakdown of which is shown in Figure 3.3.

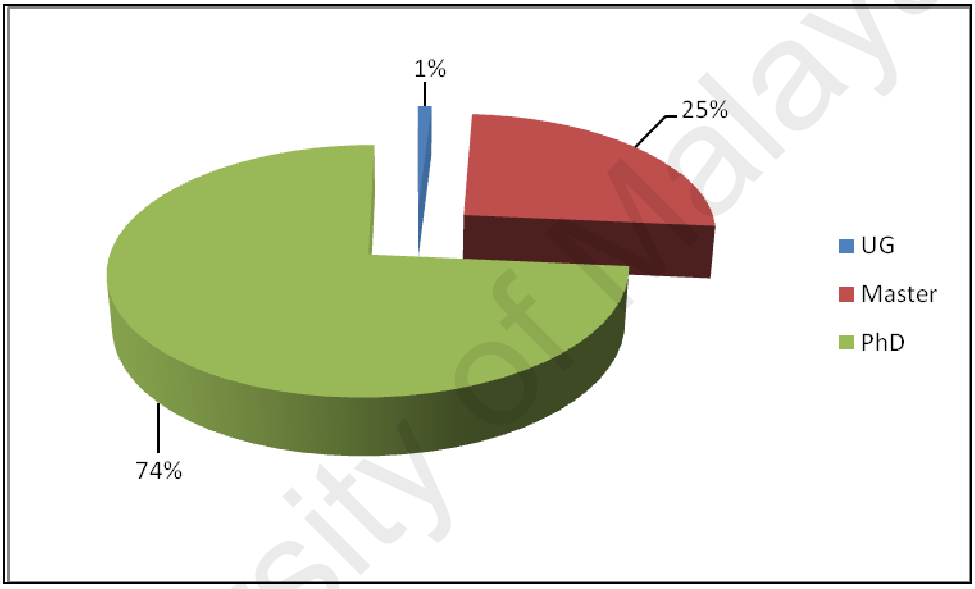

Figure 3.3: Sample of Study According to Educational Background

The sample consisted of different age groups. Most of the lecturers (33%) were above 45 years of age, followed by 23%, 19% and 18% were between 35 to 39, 30 to 34 and 40 to 44 years of age groups, respectively. Lastly, only 7% of the lecturers were between 25 to 29 years of age. The age group breakdown is shown in Figure 3.4.

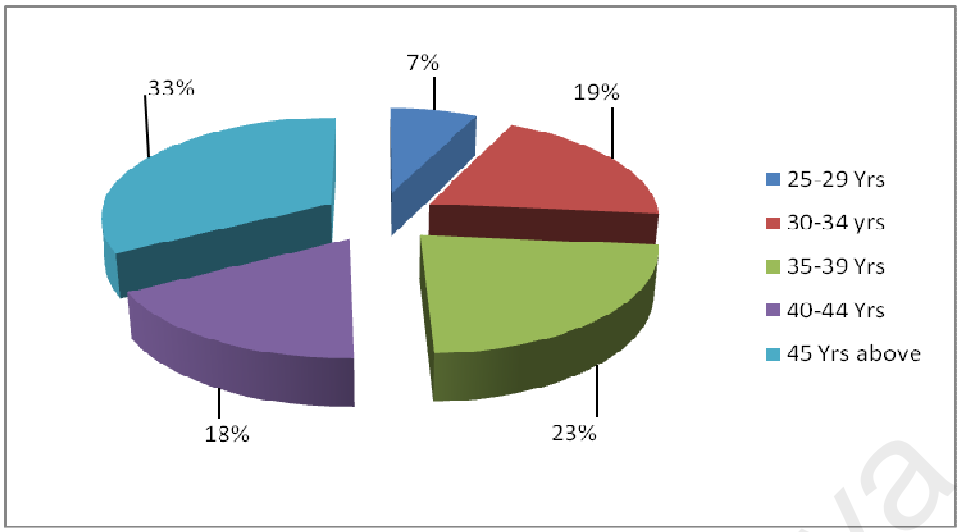

Figure 3.4: Sample of Study According to Age Groups

This study was conducted among local (88%) and international (12%) academic staffs. The nationality breakdown is shown in Figure 3.5.

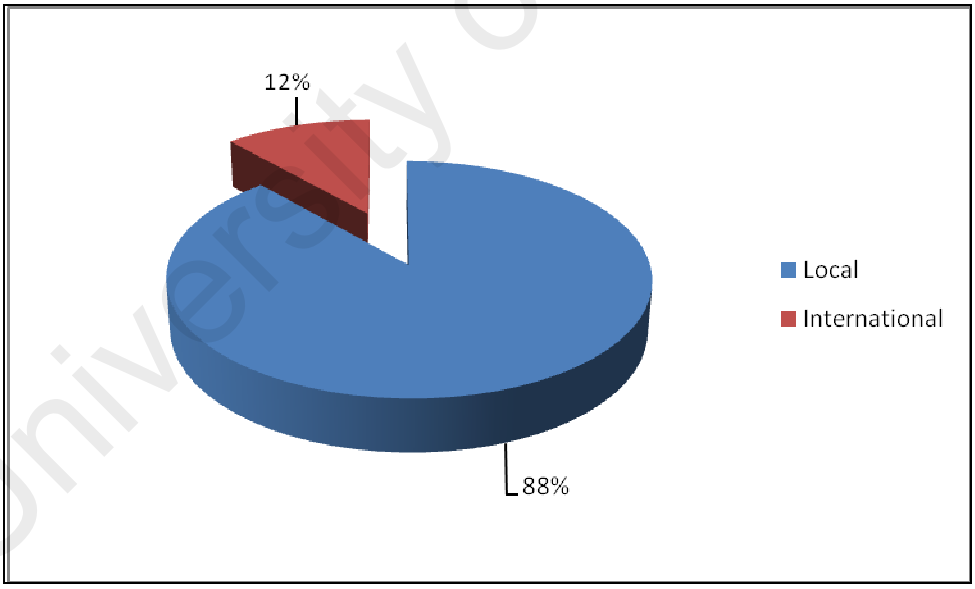

Figure 3.5: Sample of Study According to Nationality

Most of the lecturers (29%) had between 6 to 10 years of working experiences, followed by 26% which had between 1 to 5 years, and the remaining 14%, 15% and 16% of the lecturers had between 16 to 20, 11 to 15 and 21 above years of experience, respectively. The working experience breakdown is shown in Figure 3.6.

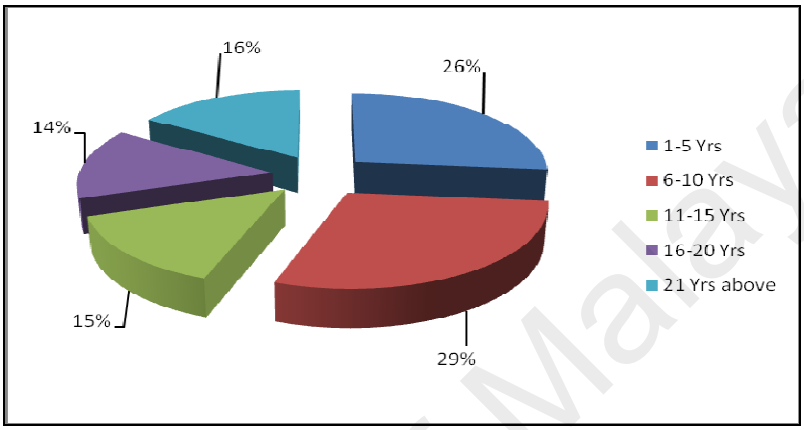

Figure 3.6: Sample of Study According to Working Experience

With regards to designations, majority of the academic staff surveyed were assistant professors/senior lecturers (44%), followed by lecturers (30%), associate professors (16%) and professors (10%), respectively. The designation breakdown is shown in Figure 3.7.

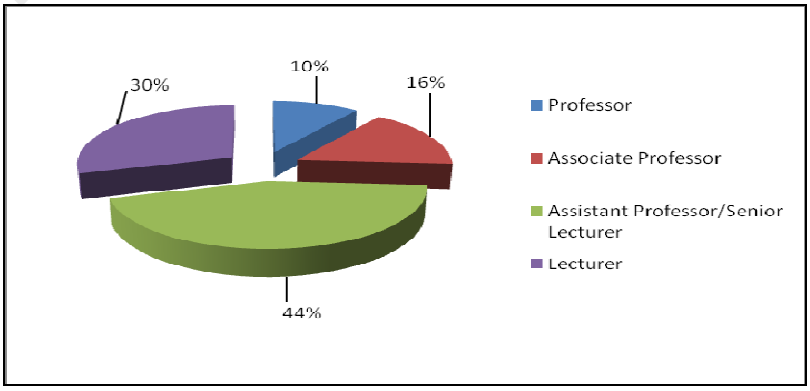

Figure 3.7: Sample of Study According to Designation

3.2.2 LECTURERS' DEMOGRAPHIC INFORMATION IN JIAXING UNIVERSITY

The 200 participants were lecturers from seven colleges of Jiaxing University. However, 4 participants were removed from the final study due to incomplete responses. They consisted of 48% male and 52% female. The gender breakdown is shown in Figure 3.8.

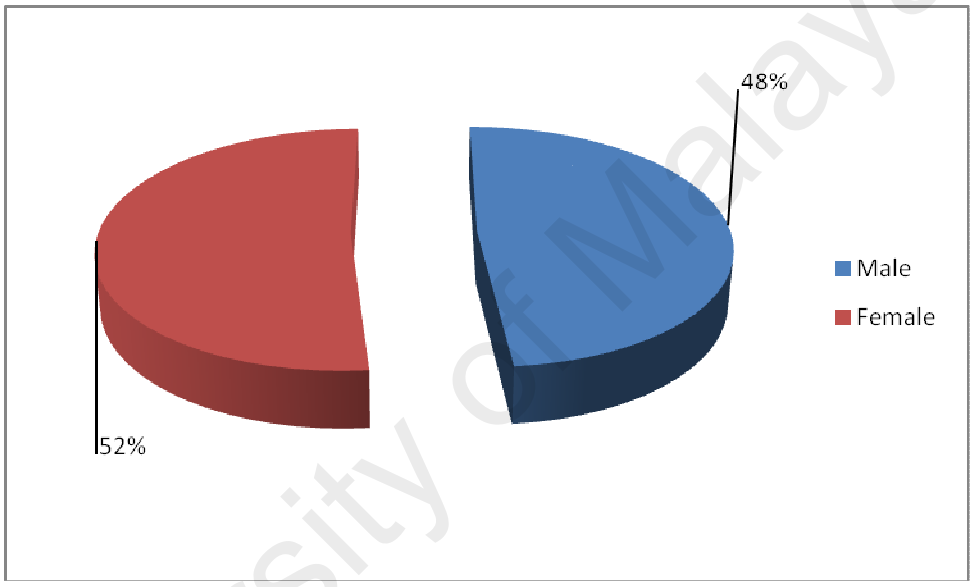

Figure 3.8: Sample of Study According to Gender

The 196 participants were lecturers from seven colleges of Jiaxing University, namely, Foreign Language Studies (CFLS), Mathematics and Engineering (CME), Biology and Chemistry (CBC), Material Engineering (CME), Education (CE), Civil Engineering & Architecture (CCEA) and Jiaxing University Nanhu (CJUN). The sample breakdown according to colleges is shown in Figure 3.9.

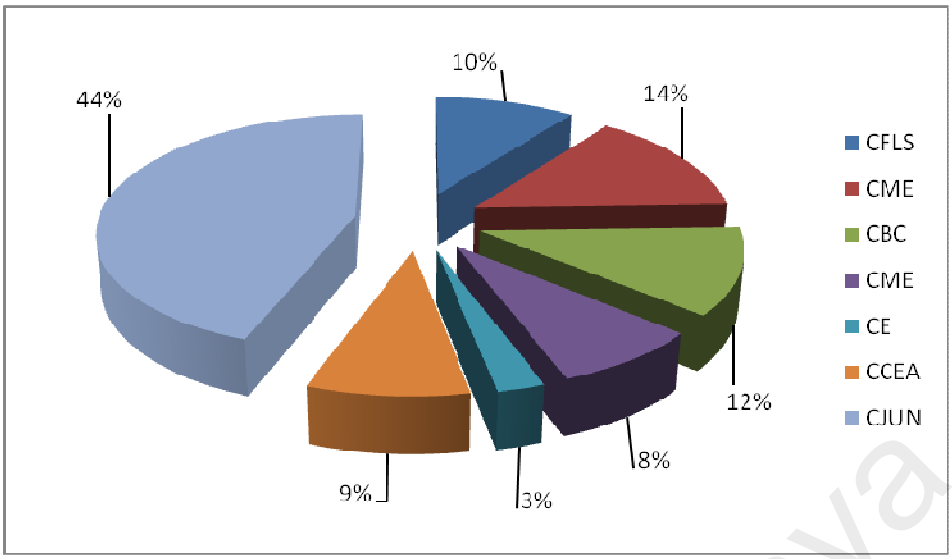

Figure 3.9: Sample of Study According to Colleges

The sample consisted of lecturer's educational background. They had different levels of educational background such as undergraduate (UG), Master and PhD and worked in various colleges in Jiaxing University. The majority of the lecturers held Master degree (48%) whereas only 19% of the lecturers were undergraduate holders and the remaining 33% were PhD degree holders. The breakdown of which is shown in Figure 3.10.

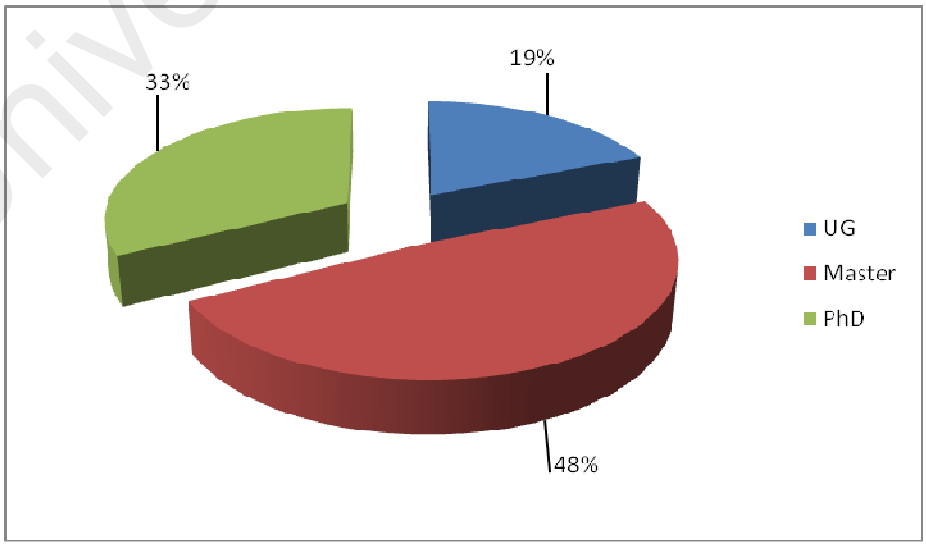

Figure 3.10: Sample of Study According to Educational Background

The sample consisted of different age groups. Most of the lecturers (29%) were between 30 to 34 years of age, followed by 25%, 21%, and 17% who were between 45 years and above, 35 to 39 and 40 to 44 years of age, respectively, whereas only 8% of the lecturers were between 25 to 29 years of age. The age group breakdown is shown in Figure 3.11

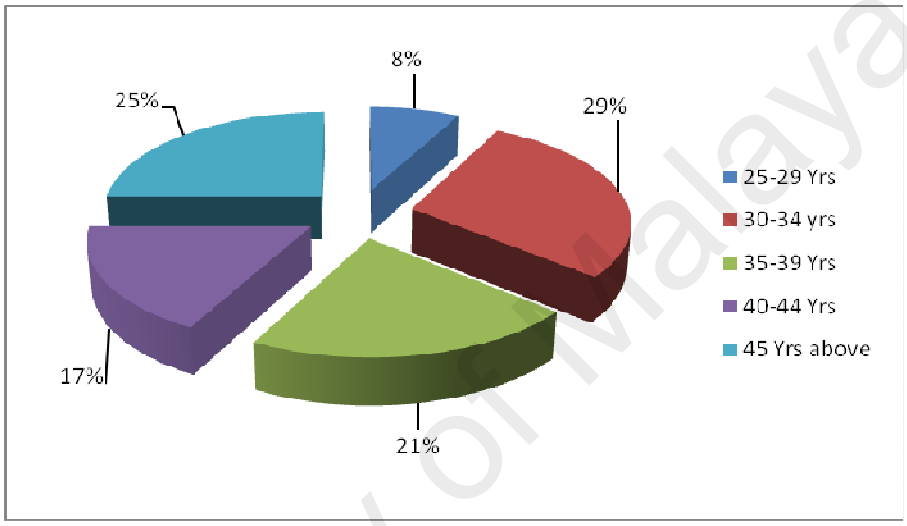

Figure 3.11: Sample of Study According to Age Groups

This study was conducted among local (100%) academic staff. The nationality breakdown is shown in Figure 3.12.

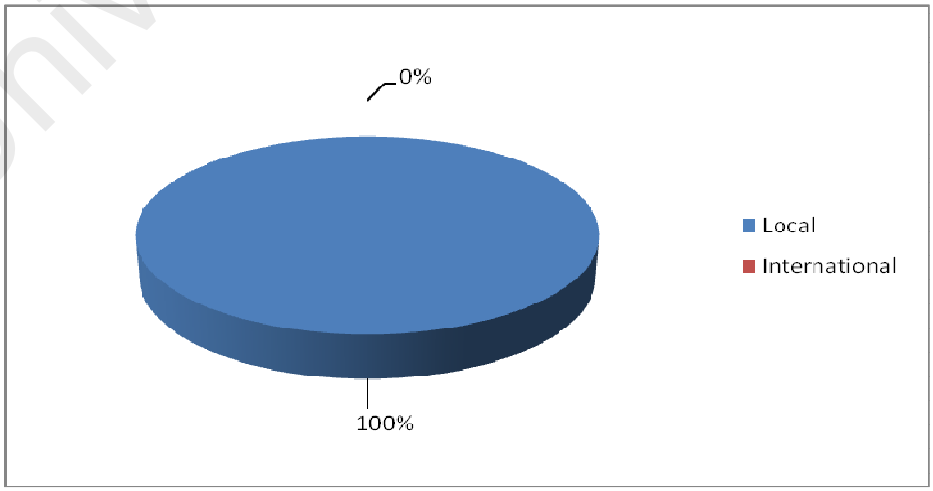

Figure 3.12: Sample of Study According to Nationality

Most of the lecturers (32%) had between 6 to 10 years of working experience, followed by 22% who had between 1 to 5 years, and the remaining 18%, 10% and 18% of the lecturers had between 11 to 150, 16 to 20 and 21 above years of experience, respectively. The working experience breakdown is shown in Figure 3.13.

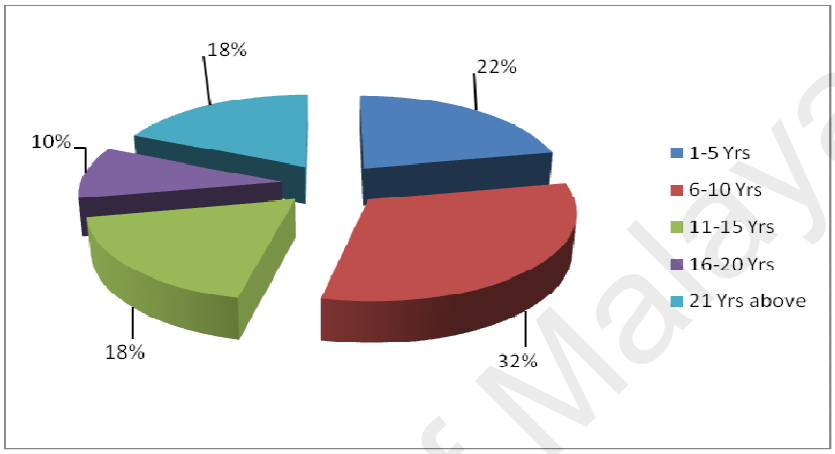

Figure 3.13: Sample of Study According to Working Experience

With regards to designation, majority of the surveyed academic staff were lecturers (53%), followed by associate professors (38%), professors (7%) and assistant professors/Senior lecturer (2%). The designation breakdown is shown in Figure 3.14.

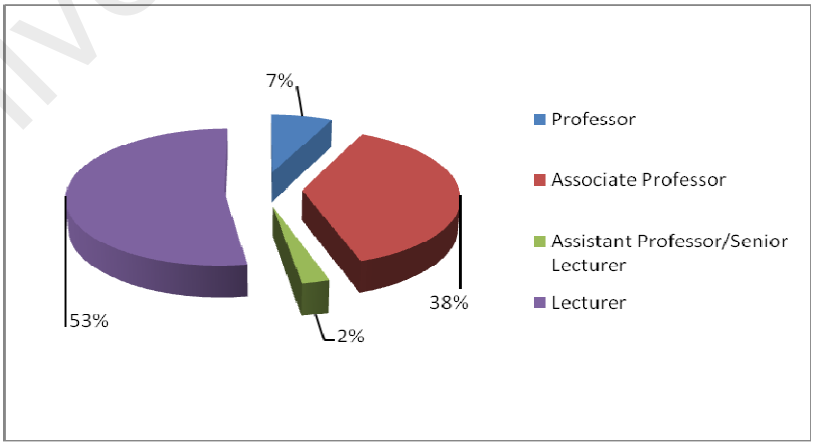

Figure 3.14: Sample of Study According to Designation

3.3 SAMPLING PROCEDURE

The respondents involved in this study were from two comprehensive public universities, namely, the University of Malaya and Jiaxing University and they are currently working there as professors, associate professors, assistant professors or senior lecturers and lecturers in the different faculties of the universities. The sample size of this study was based on previous studies For instance, Terzis et al., (2013) conducted a research on "*computer based assessment acceptance: a cross-cultural study in Greece and Mexico*". Their study was conducted at two universities in Greece and Mexico. The data for their study was collected from 117 Greek and 51 Mexican students. Similarly, Chong et al., (2012) investigated a cross-cultural study between China and Malaysia to examine consumers' decision to adopt mobile commerce. The data was collected from 172 Malaysian and 222 Chinese consumers. Teo et al., (2008) conducted a study on "*a cross-cultural examination of the intention to use technology between Singaporean and Malaysian pre-service teachers: An application of the Technology Acceptance Model (TAM)*". The respondents for their study comprised of 250 and 245 pre-service teachers in Singapore and Malaysia respectively. As such, in the current study, a total of 400 academic staffs were separated into two equal parts. Data was collected through a survey questionnaire using stratified random sampling procedure. The questionnaire was distributed to all the faculties (Arts and Social Sciences, Built Environment, Business and Accountancy, Computer Science and Information Technology, Dentistry, Economics and Administration, Education, Engineering, Language and Linguistics, Law, Medicine, Sciences and Academy of Islamic Studies) academic staff based on the total number of faculty members as well as the specific respondents of each faculty. Half of lecturers of the sample were from the University of Malaya, so the researcher was able to hand it to the lecturers of the

faculties: Arts and Social Sciences (12), Built Environment (8), Business and Accountancy (7), Computer Science and Information Technology (8), Dentistry (10), Economics and Administration (6), Education (9), Engineering (19), Language and Linguistics (14), Law (4), Medicine (61), Sciences (32) and Academy of Islamic Studies (10). On the other hand, the remaining 200 lecturers were collected from seven colleges (Foreign Language Studies, Mathematics and Engineering, Biology and Chemistry, Material Engineering, Education, Civil Engineering & Architecture and Jiaxing University Nanhu) of Jiaxing University using stratified random sampling procedure. To collect the data from Jiaxing University, the researcher traveled to China and was able to hand it to the lecturers in Foreign Language Studies (20), Mathematics and Engineering (28), Biology and Chemistry (23), Material Engineering (16), Education (5), Civil Engineering & Architecture (17) and Jiaxing University Nanhu (91). The formula of stratified random sampling procedure is as follows: (expected sample size/total population)*each faculty population = each faculty sample size. The sum of all the faculties sample size represents the total sample size of the study. The detail of stratified random sampling procedure is shown in Table 3.1.

Table 3.1: Stratified Random Sampling Procedure

Universities	Faculties/Colleges	Each Faculty Population	Expected Sample Size for Each Faculty
University of Malaya in Malaysia (Expected Sample size/Total Population)*Each faculty population e.g. (200/1965)*121 =Sample size for each faculty	Arts and Social Sciences	121	12.315
	Built Environment	75	7.633
	Business and Accountancy	72	7.328
	Computer Science and Information Technology	76	7.735
	Dentistry	97	9.872
	Economics and Administration	60	6.106
	Education	90	9.160
	Engineering	186	18.931
	Language and Linguistics	140	14.249
	Law	39	3.969
	Medicine	598	60.865
	Sciences	313	31.857
	Academy of Islamic Studies	98	9.978
Total Population of University of Malaya		1965	
Total sample size for University of Malaya			199.998
Jiaxing University in China	Foreign Language Studies	83	20.468
	Mathematics and Engineering	113	27.866
	Biology and Chemistry	95	23.427
	Material Engineering	63	15.536
	Education	19	4.685
	Civil Engineering & Architecture	68	16.769
	Jiaxing University Nanhu College	370	91.245
Total Population of Jiaxing University		811	
Total sample size for Jiaxing University			199.996

3.4 RESEARCH INSTRUMENTS

This study used a questionnaire as the primary instrument to collect data. The questionnaire consisted of seven sections. The first section consisted of 7 items about the participants' demographic information that included their gender, age, working experience, educational background, designation, faculty/college/school and

nationality. The second section consisted of 16 items intended to measure the mediator variable (use), on a 7-point Likert-type agreement scale with 1 being "never" and 7 being "always". The third, fourth and fifth sections comprised of 46 items intended to measure the other two mediator variables (perceived ease of use and perceived usefulness) and one exogenous variable (computer self-efficacy), on a 7-point Likert-type agreement scale with 1 being "strongly disagree" and 7 being "strongly agree". The sixth section involved 10 questions about the participants' intention to use of ICT facilities (mediator variable), on a 7-point Likert-type agreement scale with 1 being "very unlikely" and 7 being "very likely". The last section consisted of 10 questions that addressed the participants' perceptions of the gratification (endogenous variable) of ICT usage. To measure the endogenous (gratification), the study used a 7-point Likert scale survey questionnaire, with 1 being "very unsatisfied" and 7 being "very satisfied". The number of components is shown in Table 3.2.

Table 3.2: The number of Components Measured

Section	Components Measured	No of Items
I	Demographic Information	
II	Use	16
III	Perceived Ease of Use	15
IV	Perceived Usefulness	16
V	Computer self-efficacy	15
VI	Intention to Use	10
VII	Gratification	10
	Total	82

3.4.1 Use of ICT facilities

The items for *actual use of ICT* were adapted from previous studies (Ahmad et al., 2010; Usluel et al., 2008; Islam, 2011a; Zejno & Islam, 2012) and modified accordingly to suit the needs of the present study. *Use* was measured by sixteen items.

The items are shown in Table 3.3.

Table 3.3: Use Items

	Items
How often do you use the following ICT facilities for research and academic-related activities?	
USE1	The University online research databases/Online library research databases.
USE2	Laptop or Desktop computers.
USE3	Wireless Internet.
USE4	Web browser (www).
USE5	Search engine (e.g. Google, Yahoo, etc.).
USE6	Microsoft Office applications.
USE7	Research related software to analyze the data.
USE8	Document processing (e.g. PDF).
USE9	Computer graphics.
USE10	Email
USE11	Document editing/composing.
USE12	Computer labs.
USE13	Multimedia facilities (e.g. CD-ROM, VCD, DVD etc.).
USE14	I use ICT for preparing the course and lecture notes.
USE15	I use ICT facilities for making presentations in the course.
USE16	I use ICT facilities for carrying out studies in laboratories or workshops, and making experiments.

3.4.2 Perceived Ease of Use

The Items for *perceived ease of use* were adapted from previous studies (Islam, 2011a and 2011b; Islam 2014) and modified accordingly to address the needs of the present study. *Perceived ease of use* was measured by fifteen items. The items are shown in Table 3.4.

Table 3.4: Perceived Ease of Use Items

	Items
PEU1	I find the university ICT facilities easy to use.
PEU2	I find it easy to access the university research databases.
PEU3	It is easy for me to become skilful at using university databases for conducting research.
PEU4	Interacting with the research databases system requires minimal effort on my part.
PEU5	I find it easy to get the research databases to help facilitate my research.
PEU6	Interacting with the university research databases system is very stimulating for me.
PEU7	I find it easy to select articles/journals of different categories using research databases (Education/Engineering/Business, etc.).
PEU8	With Wireless Internet, I find it easy to access university databases to do research.
PEU9	Wireless Internet allows me to access research and learning materials from Web Browser (WWW).
PEU10	Wireless Internet is easy to use for teaching and research.
PEU11	I find it easy to use computers provided by the university.
PEU12	My interaction with university ICT services available is clear and understandable.
PEU13	I find it easy to download teaching, learning and research materials using Wireless Internet in terms of speed.
PEU14	It is easy for me to use multimedia facilities at the university.
PEU15	I find it easy to use Microsoft office for teaching and research purposes.

3.4.3 Perceived Usefulness

The Items for *perceived usefulness* were adapted from previous studies (Islam, 2011a and 2011b; Islam 2014; Ahmad et al., 2010; Usluel et al., 2008) and modified accordingly to suit the needs of the present study. *Perceived usefulness* was measured by sixteen items. The items are shown in Table 3.5.

Table 3.5: Perceived Usefulness Items

	Items
PU1	Using the ICT facilities at the university enables me to accomplish tasks more quickly.
PU2	Using the ICT services available at the university increases my research productivity.
PU3	The current university ICT system makes work more interesting.
PU4	ICT facilities at the university improve the quality of the work I do.
PU5	Using the university ICT facilities enhances my research skills.
PU6	Using the university ICT facilities would make it easier for me to find information.
PU7	ICT services at the university make information always available to users.
PU8	Using the ICT facilities helps me write my journal articles.
PU9	My job would be difficult to perform without the ICT facilities.
PU10	Using the ICT facilities saves my time.
PU11	Using the university ICT facilities provides me with the latest information on specific areas of research.
PU12	I can use ICT facilities from anywhere, anytime at the campus.
PU13	I believe that the use of ICT in the classroom enhances student learning in my discipline.
PU14	I believe that email and other forms of electronic communication are important tools in faculty/student communication.
PU15	I believe that web-based instructional materials enhance student learning.
PU16	Using the ICT services enables me to download teaching, learning and research materials from the internet.

3.4.4 Computer Self-Efficacy

The Items for *computer self-efficacy* were adapted from previous studies (Islam, 2011a and 2011b; Islam 2014; Ahmad et al., 2010) and modified accordingly to suit the needs of the present study. *Computer self-efficacy* was measured by fifteen items.

The items are shown in Table 3.6.

Table 3.6: Computer Self-Efficacy Items

	Items
CSE1	I have the skills required to use computer applications for writing my research papers.
CSE2	I have the skills and knowledge required to use computer applications for demonstrating specific concepts in class.
CSE3	I have the skills required to use computer applications for presenting lectures.
CSE4	I have the skills required to communicate electronically with my colleagues and students.
CSE5	I have the ability to e-mail, chat, download teaching, learning and research materials, and search different websites.
CSE6	I have the ability to use the Wireless Internet service provided by the university.
CSE7	I have the skills required to use ICT facilities to enhance the effectiveness of my teaching, learning and research.
CSE8	I feel capable of using the university research databases for writing journal papers.
CSE9	I have the ability to navigate my way through the ICT facilities.
CSE10	I have the skills required to use the ICT facilities to enhance the quality of my research works.
CSE11	I have the ability to save and print journals/articles from the research databases.
CSE12	I have the knowledge and skills required to benefit from using the university ICT facilities.
CSE13	I am capable of accessing the research databases from the university website.
CSE14	I am capable to download and install research related software using ICT facilities at the university.
CSE15	I am capable of using multimedia facilities for delivering lecturers.

3.4.5 Intention to Use

The Items for *intention to use* were adapted from previous studies (Islam, 2011a; Ahmad et al., 2010) and modified accordingly to suit the needs of the present study. *Intention to use* was measured by ten items. The items are indicated in Table 3.7.

Table 3.7: Intention to Use Items

	Items
INT1	I will use the ICT facilities to carry out my research activities.
INT2	I will use computer applications to present lecture materials in class.
INT3	I will use Microsoft office applications to write my research papers.
INT4	I will teach a course that will be delivered totally on the world wide web.
INT5	I intend to use ICT facilities for teaching, learning and research purposes frequently.
INT6	I intend to download research materials from the university databases frequently.
INT7	I will use the university research databases to update myself on the research areas I am pursuing.
INT8	I intend to use the ICT facilities to upgrade my research performance.
INT9	I will use the university research databases to write outstanding journal articles.
INT10	I intend to use research related software to analyze the data.

3.4.6 Gratification

The Items for *gratification* were adapted from previous studies (Islam, 2011a & 2011b; Islam 2014) and modified accordingly to suit the needs of the present study. *Gratification* was measured by ten items. The items are shown in Table 3.8.

Table 3.8: Gratification Items

	Items
GRAT1	Overall I am satisfied with the ease of completing my task using ICT facilities.
GRAT2	I am satisfied with the ICT facilities provided by the university.
GRAT3	I am satisfied with the ease of use of the ICT facilities.
GRAT4	The university ICT facilities have greatly affected the way I search for information and conduct my research.
GRAT5	Providing the ICT is an indispensable services provided by the university.
GRAT6	Overall I am satisfied with the amount of time it takes to complete my task.
GRAT7	I am satisfied with the structure of accessible information (available as categories of research domain, or by date of issue—of journals in particular, or as full-texts or abstracts of theses and dissertations) of the university research databases.
GRAT8	I am satisfied with the support information provided by the university's ICT facilities.
GRAT9	I am satisfied in using ICT facilities for teaching, learning and research.
GRAT10	Overall I am satisfied with the Wireless Internet service provided at the university.

3.4.7 Pilot Test

The validity of an instrument is concerned with the soundness and the effectiveness of the measurement. According to Babbie (2001), validity explains a measure that precisely reflects the concept which is intended to be measured. The questionnaire items used in this study were adopted and modified from Islam (2011a and 2011b), Islam (2014), Ahmad et al., (2010), Usluel et al., (2008) and Zejno and Islam (2012). Their instruments were validated using well established statistical tools. Specially, Islam (2011a and 2011b; 2014) developed and validated previous instruments by applying a Rasch Model and most of the items in the present study were adopted and

modified from these instrument. Moreover, the Technology Acceptance Model (Davis, 1989), Technology Satisfaction Model (Islam, 2014) and Online Database Adoption and Satisfaction (ODAS) model were applied as a theoretical framework for this study. According to Mathieson, Peacock, and Chin (2001), the TAM has been examined and broadly accepted among researchers as a theoretically-based model with good predictive validity and confirmed reliability in the information technology field. The instrument of Technology Adoption and Gratification (TAG) model was translated from English to Chinese in order to collect data from Jiaxing University in China. The questionnaire was translated by a young researcher Qian Xiuxiu from Jiaxing University who was my former research partner. The translated questionnaire was verified by Professor Dr. Zhang Quan and Professor Tao Danyu from the college of foreign language studies, Jiaxing University.

To establish the validity and reliability of the questionnaire items, a Rasch analysis was used. Using Winsteps version 3.49, a pilot test was conducted with 82 items. A total of 60 lecturers were equally collected from the University of Malaya and Jiaxing University to conduct pilot tests. The findings of the Rasch model showed that the summary statistics of the 82 items obtained from the Rasch analysis, indicating the items measured reliability (r = .90), and persons measured reliability (r = .95). In addition, items separation (3.05) and persons separation (4.35) are statistically significant as shown in Figure 3.15.

```
TABLE 3.1 TAG MODEL                                ZOU999ws.txt Nov 16 21:43 2014
INPUT: 60 PERSONS, 82 ITEMS  MEASURED: 60 PERSONS, 82 ITEMS, 7 CATS         3.49
-------------------------------------------------------------------------------

     SUMMARY OF 60 MEASURED PERSONS
+-------------------------------------------------------------------------------+
|           RAW                          MODEL          INFIT        OUTFIT     |
|          SCORE     COUNT     MEASURE   ERROR      MNSQ   ZSTD   MNSQ   ZSTD  |
|-------------------------------------------------------------------------------|
| MEAN     459.8      82.0         .97     .11      1.17     .3   1.12     .1  |
| S.D.      47.3        .0         .65     .04       .70    2.9    .64    2.9  |
| MAX.     563.0      82.0        3.38     .30      4.80    7.7   4.38    6.7  |
| MIN.     368.0      82.0         .09     .08       .27   -6.4    .24   -6.8  |
|-------------------------------------------------------------------------------|
| REAL RMSE    .15  ADJ.SD     .64  SEPARATION  4.35  PERSON RELIABILITY  .95  |
|MODEL RMSE    .12  ADJ.SD     .64  SEPARATION  5.37  PERSON RELIABILITY  .97  |
| S.E. OF PERSON MEAN = .09                                                     |
+-------------------------------------------------------------------------------+
PERSON RAW SCORE-TO-MEASURE CORRELATION = .95
CRONBACH ALPHA (KR-20) PERSON RAW SCORE RELIABILITY = .96

     SUMMARY OF 82 MEASURED ITEMS
+-------------------------------------------------------------------------------+
|           RAW                          MODEL          INFIT        OUTFIT     |
|          SCORE     COUNT     MEASURE   ERROR      MNSQ   ZSTD   MNSQ   ZSTD  |
|-------------------------------------------------------------------------------|
| MEAN     336.4      60.0         .00     .13      1.02    -.1   1.12     .1  |
| S.D.      32.1        .0         .45     .02       .53    2.3    .78    2.7  |
| MAX.     390.0      60.0        1.44     .19      2.72    6.7   5.06    9.7  |
| MIN.     195.0      60.0       -1.11     .09       .40   -3.5    .42   -3.4  |
|-------------------------------------------------------------------------------|
| REAL RMSE    .14  ADJ.SD     .43  SEPARATION  3.05  ITEM   RELIABILITY  .90  |
|MODEL RMSE    .13  ADJ.SD     .43  SEPARATION  3.38  ITEM   RELIABILITY  .92  |
| S.E. OF ITEM MEAN = .05                                                       |
+-------------------------------------------------------------------------------+
UMEAN=.000 USCALE=1.000
ITEM RAW SCORE-TO-MEASURE CORRELATION = -.98
```

Figure 3.15: Summary Statistics

The item polarity map exhibits most of the items measured in the same direction (ptmea. Corr. > 0.30), which are greater than the recommended value (.30). However, few items discovered low point measure correlations due to the small sample size as shown in Figure 3.16.

TABLE 26.1 TAG MODEL ZOU999wa.txt Nov 16 21:43 2
INPUT: 60 PERSONS, 82 ITEMS MEASURED: 60 PERSONS, 82 ITEMS, 7 CATS 3

PERSON: REAL SEP.: 4.35 REL.: .95 ... ITEM: REAL SEP.: 3.05 REL.: .90

ITEMS STATISTICS: CORRELATION ORDER

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	ITEMS
4	372	60	-.59	.15	2.42	4.7	3.23	6.3	.01	4use4
2	390	60	-1.11	.19	1.32	1.3	1.80	2.5	.05	2use2
16	285	60	.68	.10	2.72	6.6	3.31	7.8	.07	16use16
12	195	60	1.44	.09	2.54	6.7	3.06	7.7	.11	12use12
3	362	60	-.37	.14	2.21	4.2	2.28	4.3	.13	3use3
1	272	60	.80	.09	2.11	5.0	2.23	5.1	.18	1use1
13	286	60	.67	.10	1.87	3.9	2.34	5.3	.18	13use13
14	369	60	-.52	.15	1.94	3.5	2.27	4.2	.28	14use14
65	360	60	-.33	.14	2.20	4.2	5.06	9.7	.28	65int3
15	357	60	-.27	.14	2.00	3.6	2.14	4.0	.29	15use15
5	388	60	-1.04	.18	1.40	1.6	1.31	1.2	.29	5use5
66	291	60	.62	.10	1.34	1.7	2.57	5.8	.29	66int4
6	375	60	-.66	.16	1.77	2.9	1.84	2.9	.30	6use6
10	383	60	-.88	.17	1.18	.8	1.16	.7	.30	10use10
11	366	60	-.45	.15	1.76	2.9	1.62	2.4	.30	11use11
9	270	60	.81	.09	2.11	5.0	2.14	4.8	.31	9use9
7	288	60	.65	.10	1.42	2.1	1.46	2.2	.31	7use7
17	334	60	.11	.12	.81	-.9	1.01	.1	.35	17pau1
27	326	60	.22	.11	1.25	1.2	1.47	2.0	.37	27pau11
8	340	60	.02	.12	1.13	.6	1.17	.8	.38	8use8
40	360	60	-.33	.14	1.14	.7	1.17	.8	.38	40pu9
31	362	60	-.37	.14	1.03	.2	1.01	.1	.43	31pau15
43	285	60	.68	.10	1.46	2.3	1.52	2.4	.44	43pu12
41	357	60	-.27	.14	.89	-.5	.86	-.6	.44	41pu10
44	343	60	-.03	.13	.89	-.4	.98	.0	.44	44pu13
45	352	60	-.18	.13	.97	-.1	1.01	.1	.44	45pu14
18	327	60	.21	.12	.65	-1.8	.71	-1.5	.47	18pau2
52	372	60	-.59	.15	.83	-.7	.74	-1.1	.49	52cae5
29	292	60	.61	.10	1.36	1.8	1.36	1.8	.49	29pau13
82	287	60	.66	.10	1.35	1.8	1.38	1.9	.49	82gsat10
47	351	60	-.16	.13	.73	-1.3	.69	-1.5	.49	47pu16
42	350	60	-.14	.13	.67	-1.6	.67	-1.6	.50	42pu11
46	344	60	-.04	.13	.72	-1.3	.70	-1.5	.51	46pu15
21	316	60	.35	.11	1.15	.8	1.22	1.1	.51	21pau5
48	357	60	-.27	.14	.69	-1.5	.78	-1.0	.51	48cae1
39	340	60	.02	.12	.76	-1.1	.81	-.9	.51	39pu8
19	325	60	.23	.11	.55	-2.4	.59	-2.2	.52	19pau3
26	313	60	.38	.11	1.12	.6	1.14	.7	.53	26pau10
51	358	60	-.29	.14	.96	-.1	.80	-.9	.54	51cae4
20	301	60	.51	.10	.91	-.4	.96	-.1	.55	20pau4
25	318	60	.32	.11	1.05	.3	1.06	.3	.55	25pau9
77	347	60	-.09	.13	.74	-1.2	.71	-1.4	.55	77gsat5
58	369	60	-.52	.15	.63	-1.9	.56	-2.2	.56	58cae11
22	293	60	.60	.10	.85	-.8	.88	-.6	.56	22pau6
53	370	60	-.54	.15	.64	-1.8	.58	-2.1	.56	53cae6
50	364	60	-.41	.14	.81	-.8	.70	-1.4	.56	50cae3
61	350	60	-.14	.13	1.07	.4	.97	.0	.56	61cae14
75	323	60	.26	.11	.64	-1.9	.67	-1.7	.56	75gsat3
55	347	60	-.09	.13	.67	-1.6	.66	-1.7	.57	55cae8
79	322	60	.27	.11	.60	-2.1	.66	-1.8	.57	79gsat7
60	353	60	-.20	.13	.73	-1.3	.64	-1.8	.57	60cae13
68	355	60	-.23	.14	.82	-.8	.84	-.7	.57	68int6
23	324	60	.25	.11	.76	-1.2	.90	-.4	.58	23pau7
76	326	60	.22	.11	.61	-2.0	.60	-2.2	.58	76gsat4
72	351	60	-.16	.13	.94	-.2	.82	-.8	.58	72int10
64	369	60	-.52	.15	.96	-.1	.85	-.6	.58	64int2
38	322	60	.27	.11	.74	-1.3	.76	-1.2	.59	38pu7
63	368	60	-.50	.15	.75	-1.1	.69	-1.4	.59	63int1
67	354	60	-.21	.13	.68	-1.6	.66	-1.7	.59	67int5
73	336	60	.08	.12	.54	-2.5	.63	-2.0	.59	73gsat1
24	295	60	.58	.10	1.09	.5	1.15	.8	.59	24pau8
71	348	60	-.11	.13	1.03	.2	.92	-.3	.59	71int9
59	364	60	-.41	.14	.64	-1.8	.55	-2.3	.59	59cae12
80	324	60	.25	.11	.60	-2.1	.62	-2.1	.59	80gsat8
28	316	60	.35	.11	.59	-2.2	.58	-2.4	.60	28pau12
54	361	60	-.35	.14	.54	-2.4	.52	-2.5	.60	54cae7
70	356	60	-.25	.14	.77	-1.0	.71	-1.4	.60	70int8
49	359	60	-.31	.14	.52	-2.6	.52	-2.6	.60	49cae2
57	357	60	-.27	.14	.60	-2.1	.56	-2.3	.61	57cae10
81	333	60	.12	.12	.52	-2.6	.51	-2.7	.61	81gsat9
69	354	60	-.21	.13	.76	-1.1	.73	-1.3	.61	69int7
62	372	60	-.59	.15	.58	-2.2	.54	-2.3	.62	62cae15
32	339	60	.04	.12	.65	-1.7	.76	-1.1	.62	32pu1
37	338	60	.05	.12	.67	-1.6	.66	-1.8	.62	37pu6
34	315	60	.36	.11	.66	-1.8	.78	-1.1	.63	34pu3
78	321	60	.28	.11	.59	-2.2	.61	-2.1	.63	78gsat6
36	317	60	.33	.11	.63	-2.0	.68	-1.7	.63	36pu5
35	329	60	.18	.12	.67	-1.7	.68	-1.7	.63	35pu4
74	323	60	.26	.11	.51	-2.8	.51	-2.8	.64	74gsat2
30	319	60	.31	.11	.62	-2.0	.62	-2.1	.67	30pau14
56	351	60	-.16	.13	.40	-3.5	.42	-3.4	.67	56cae9
33	333	60	.12	.12	.59	-2.1	.62	-2.0	.69	33pu2
MEAN	336.	60.	.00	.13	1.02	-.1	1.12	.1		
S.D.	32.	0.	.45	.02	.53	2.3	.78	2.7		

Figure 3.16: Item Polarity Map

The item map exhibits that the map of the valid items is located in their calibrations on a single continuum. As shown on the right hand side of Figure 3.17, the items on this single continuum are structured from the "less difficult to be rated as technology adoption and gratification" to the "more difficult to be rated as technology adoption and gratification" The left hand side of this figure also matches the level of a person's ability in a single line, whereby the respondents are ordered from the "higher level of agreement to endorse lecturers' adoption and gratification with the ICT usage" to the "lower level agreement to endorse lecturers' adoption and gratification with the ICT usage". Therefore, this study demonstrated that the most difficult item was *use12* and the least difficult use2, although the majority of the lecturers elected to use the ICT facilities in higher education as shown in Figure 3.17.

```
TABLE 12.2 TAG MODEL                              ZOU999ws.txt Nov 16 21:43 2014
INPUT: 60 PERSONS, 82 ITEMS  MEASURED: 60 PERSONS, 82 ITEMS, 7 CATS         3.49
-------------------------------------------------------------------------------

       PERSONS MAP OF ITEMS
          <more>|<rare>
    4           +
                |
                |
                |
                |
            X   |
                |
                |
    3           +
            X   |
                |
                |
            X   |
                |
              T|
            X   |
    2           +
            X   |
           XX   |
          XXX S|
           XX   |  12use12
          XXX   |
         XXXX   |
                |
    1   XXXXXX M+
      XXXXXXXX  |T 9use9
           XXX  |  1use1
       XXXXXXX  |  13use13   16use16   22peu6    24peu8    29peu13   43pu12
                   66int4     7use7     82grat10
         XXXXX  |S 20peu4
          XXXX S|  21peu5    25peu9    26peu10   28peu12   34pu3     36pu5
        XXXXXX  |  18peu2    19peu3    23peu7    27peu11   30peu14   38pu7
                   74grat2    75grat3   76grat4   78grat6   79grat7   80grat8
           XX   |  17peu1    33pu2     35pu4     73grat1   81grat9
    0           +M 32pu1     37pu6     39pu8     44pu13    46pu15    8use8
                |  42pu11    45pu14    47pu16    55cse8    56cse9    61cse14
                   71int9     72int10   77grat5
                |  15use15   41pu10    48cse1    49cse2    51cse4    57cse10
                   60cse13    67int5    68int6    69int7    70int8
              T|  31peu15    3use3     40pu9     50cse3    54cse7    59cse12
                   65int3
                |S 11use11   14use14   53cse6    58cse11   63int1    64int2
                |  4use4     52cse5    62cse15   6use6
                |
                |T 10use10
   -1           +  5use5
                |  2use2
                |
                |
                |
                |
                |
   -2           +
          <less>|<frequ>
```

Figure 3.17: Item Map

The item fit order indicated that most of the items showed good item fit and were constructed on a continuum of increasing intensity. However, seven items (int3, use16, use4, use12, int4, use13, use3) showing a misfit to the Rasch model had to be

slightly revised in order to validate the final questionnaire as shown in Figure 3.18. Statistically, INFIT and OUTFIT Mean square (MNSQ) statistics for items should be greater than 0.5 and less than 1.5 for rating scale application. Similarly, mean square (MNSQ) statistics for Pearson measures should also be less than 1.8.

TABLE 10.1 TAG MODEL ZOU999wa.txt Nov 16 21:43 2014
INPUT: 60 PERSONS, 82 ITEMS MEASURED: 60 PERSONS, 82 ITEMS, 7 CATS 3.49

PERSON: REAL SEP.: 4.35 REL.: .95 ... ITEM: REAL SEP.: 3.05 REL.: .90

ITEMS STATISTICS: MISFIT ORDER

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.		ITEMS
65	360	60	-.33	.14	2.20	4.2	5.06	9.7	A	.22	65int3
16	285	60	.68	.10	2.72	6.6	3.31	7.8	B	.07	16usa16
4	372	60	-.59	.15	2.42	4.7	3.23	6.3	C	.01	4usa4
12	195	60	1.44	.09	2.54	6.7	3.06	7.7	D	.11	12usa12
66	291	60	.62	.10	1.34	1.7	2.57	5.8	E	.24	66int4
13	286	60	.67	.10	1.87	3.9	2.34	5.3	F	.18	13usa13
3	362	60	-.37	.14	2.21	4.2	2.28	4.3	G	.13	3usa3
14	369	60	-.52	.15	1.24	3.5	1.27	4.2	H	.19	14usa14
1	272	60	.80	.09	1.11	5.0	1.23	5.1	I	.18	1usa1
15	357	60	-.27	.14	1.00	3.6	1.14	4.0	J	.22	15usa15
9	270	60	.81	.09	1.11	5.0	1.14	4.8	K	.30	9usa9
6	375	60	-.66	.16	1.47	2.9	1.54	2.9	L	.24	6usa6
2	390	60	-1.11	.19	1.32	1.3	1.60	2.5	M	.05	2usa2
11	366	60	-.45	.15	1.16	2.9	1.62	2.4	N	.30	11usa11
43	285	60	.68	.10	1.46	2.3	1.52	2.4	O	.44	43pu12
27	326	60	.22	.11	1.25	1.2	1.47	2.0	P	.37	27pu11
7	288	60	.65	.10	1.42	2.1	1.46	2.2	Q	.31	7usa7
5	388	60	-1.04	.18	1.40	1.6	1.31	1.2	R	.24	5usa5
82	287	60	.66	.10	1.35	1.8	1.38	1.9	S	.49	82gsat10
29	292	60	.61	.10	1.36	1.8	1.36	1.8	T	.49	29pu13
21	316	60	.35	.11	1.15	.8	1.22	1.1	U	.51	21pu5
10	383	60	-.88	.17	1.18	.8	1.16	.7	V	.28	10usa10
40	360	60	-.33	.14	1.14	.7	1.17	.8	W	.38	40pu9
8	340	60	.02	.12	1.13	.6	1.17	.8	X	.38	8usa8
24	295	60	.58	.10	1.09	.5	1.15	.8	Y	.59	24pu8
26	313	60	.38	.11	1.12	.6	1.14	.7	Z	.53	26pu10
67	354	60	-.21	.13	.68	-1.6	.66	-1.7	z	.59	67int5
35	329	60	.18	.12	.67	-1.7	.68	-1.7	y	.63	35pu4
36	317	60	.33	.11	.63	-2.0	.68	-1.7	x	.63	36pu5
75	323	60	.26	.11	.64	-1.9	.67	-1.7	w	.56	75gsat3
42	350	60	-.14	.13	.67	-1.6	.67	-1.6	v	.50	42pu11
55	347	60	-.09	.13	.67	-1.6	.66	-1.7	u	.57	55usa8
37	338	60	.05	.12	.67	-1.6	.66	-1.8	t	.62	37pu6
79	322	60	.27	.11	.60	-2.1	.66	-1.8	s	.57	79gsat7
59	364	60	-.41	.14	.64	-1.8	.55	-2.3	r	.59	59usa12
53	370	60	-.54	.15	.64	-1.8	.58	-2.1	q	.56	53usa6
58	369	60	-.52	.15	.63	-1.9	.56	-2.2	p	.56	58usa11
73	336	60	.08	.12	.54	-2.5	.63	-2.0	o	.59	73gsat1
33	333	60	.12	.12	.59	-2.1	.62	-2.0	n	.69	33pu2
30	319	60	.31	.11	.62	-2.0	.62	-2.1	m	.67	30pu14
80	324	60	.25	.11	.60	-2.1	.62	-2.1	l	.59	80gsat8
78	321	60	.28	.11	.59	-2.2	.61	-2.1	k	.63	78gsat6
76	326	60	.22	.11	.61	-2.0	.60	-2.2	j	.58	76gsat4
57	357	60	-.27	.14	.60	-2.1	.56	-2.3	i	.61	57usa10
28	316	60	.35	.11	.59	-2.2	.58	-2.4	h	.60	28pu12
19	325	60	.23	.11	.55	-2.4	.59	-2.2	g	.52	19pu3
62	372	60	-.59	.15	.58	-2.2	.54	-2.3	f	.62	62usa15
54	361	60	-.35	.14	.54	-2.4	.52	-2.5	e	.60	54usa7
81	333	60	.12	.12	.52	-2.6	.51	-2.7	d	.61	81gsat9
49	359	60	-.31	.14	.52	-2.6	.52	-2.6	c	.60	49usa2
74	323	60	.26	.11	.51	-2.8	.51	-2.8	b	.64	74gsat2
56	351	60	-.16	.13	.40	-3.5	.42	-3.4	a	.67	56usa9
MEAN	336.	60.	.00	.13	1.02	-.1	1.12	.1			
S.D.	32.	0.	.45	.02	.53	2.3	.78	2.7			

Figure 3.18: Item Fit Order

This study discovered that the variance explained by the measures was 48% which indicated that the items were able to endorse the lecturers' adoption and gratification in using ICT facilities as shown in Figure 3.19.

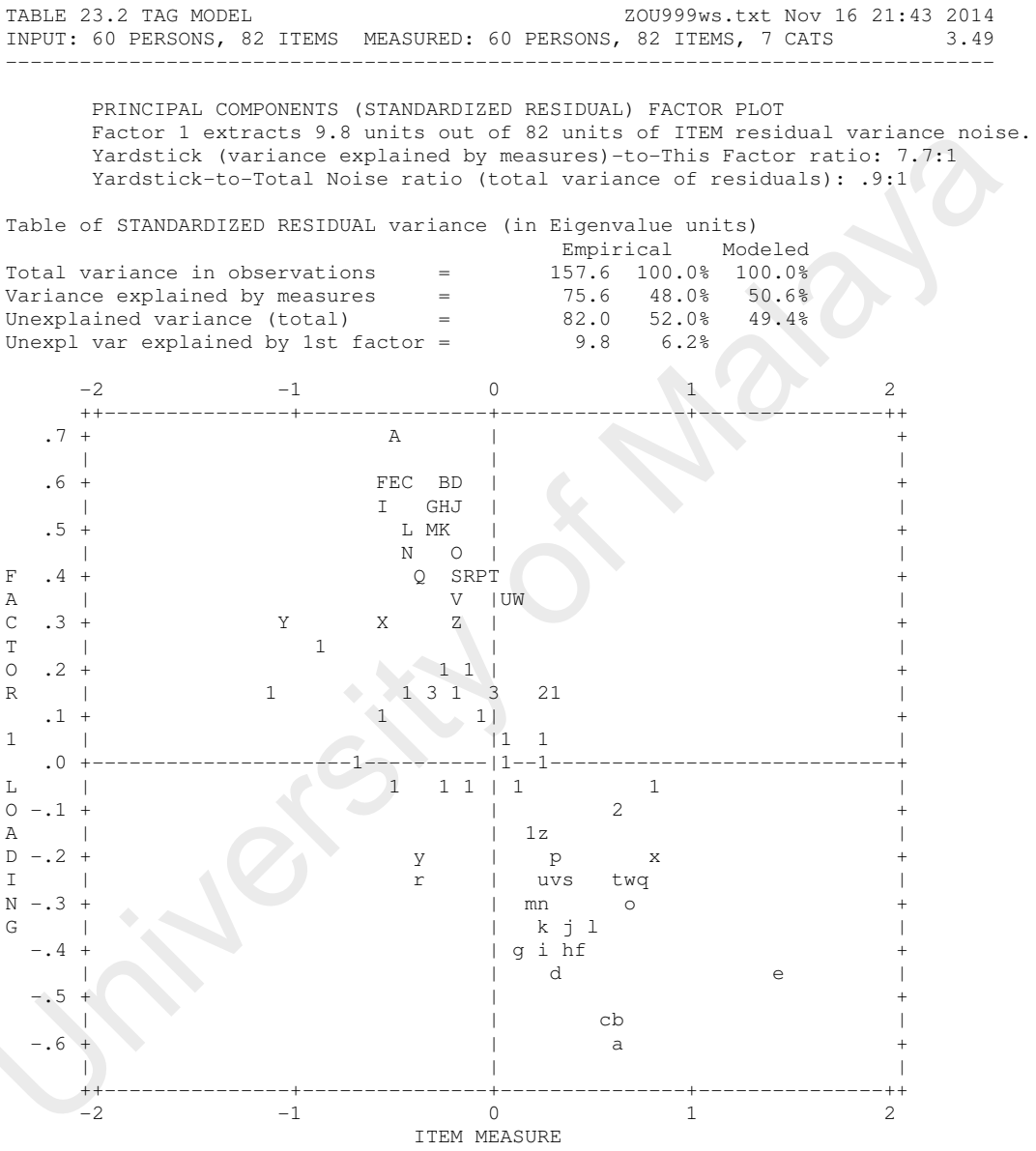

Figure 3.19: Principal Component

3.4.8 Reliability and Validity of Instrument

The questionnaire's reliability and validity were established through a RASCH Model applying Winsteps version 3.49. A total of 396 lecturers were collected from the different faculties of the University of Malaya and Jiaxing University for the final validation. The findings of the Rasch analyses discovered in the summary statistics were that: (i) the items reliability was found to be 0.98 (SD=195.5), while the persons reliability was 0.96 (SD=57.8); (ii) the items and persons separation were 7.99 and 5.00, respectively as shown in Figure 3.20.

```
TABLE 3.1 TAG MODEL                                ZOU999ws.txt Nov 16 23:14 2014
INPUT: 396 PERSONS, 82 ITEMS  MEASURED: 396 PERSONS, 82 ITEMS, 7 CATS       3.49
-------------------------------------------------------------------------------

     SUMMARY OF 396 MEASURED PERSONS
+-------------------------------------------------------------------------------+
|           RAW                          MODEL          INFIT        OUTFIT     |
|          SCORE     COUNT     MEASURE   ERROR       MNSQ   ZSTD   MNSQ   ZSTD |
|-------------------------------------------------------------------------------|
| MEAN     455.8      82.0        1.02     .12       1.14     .1   1.10     .0 |
| S.D.      57.8        .1         .78     .04        .68    3.1    .64    3.0 |
| MAX.     568.0      82.0        4.14     .41       4.99    9.3   5.52    9.3 |
| MIN.     238.0      81.0        -.70     .08        .17   -7.3    .17   -7.5 |
|-------------------------------------------------------------------------------|
| REAL RMSE    .15  ADJ.SD     .76  SEPARATION  5.00  PERSON RELIABILITY  .96 |
|MODEL RMSE    .13  ADJ.SD     .77  SEPARATION  6.12  PERSON RELIABILITY  .97 |
| S.E. OF PERSON MEAN = .04                                                     |
+-------------------------------------------------------------------------------+
        VALID RESPONSES:  99.9%

     SUMMARY OF 82 MEASURED ITEMS
+-------------------------------------------------------------------------------+
|           RAW                          MODEL          INFIT        OUTFIT     |
|          SCORE     COUNT     MEASURE   ERROR       MNSQ   ZSTD   MNSQ   ZSTD |
|-------------------------------------------------------------------------------|
| MEAN    2201.2     396.0         .00     .05       1.03    -.3   1.10     .0 |
| S.D.     195.5        .1         .44     .01        .44    4.6    .56    4.9 |
| MAX.    2533.0     396.0        1.39     .07       2.53    9.9   3.06    9.9 |
| MIN.    1372.0     395.0       -1.00     .04        .56   -6.4    .57   -5.9 |
|-------------------------------------------------------------------------------|
| REAL RMSE    .05  ADJ.SD     .43  SEPARATION  7.99  ITEM   RELIABILITY  .98 |
|MODEL RMSE    .05  ADJ.SD     .43  SEPARATION  8.71  ITEM   RELIABILITY  .99 |
| S.E. OF ITEM MEAN = .05                                                       |
+-------------------------------------------------------------------------------+
UMEAN=.000 USCALE=1.000
```

Figure 3.20: Summary of Statistics

The item polarity map exhibits the majority of the items measured in the same direction (ptmea. Corr. > 0.31), which are greater than the recommended value (.30). However, only three items (use13, use, 12 and use3) were slightly smaller than the recommended value as shown in Figure 3.21.

TABLE 26.1 TAG MODEL ZOU999wa.txt Nov 16 23:14 20
INPUT: 396 PERSONS, 82 ITEMS MEASURED: 396 PERSONS, 82 ITEMS, 7 CATS 3.

PERSON: REAL SEP.: 5.00 REL.: .96 ... ITEM: REAL SEP.: 7.99 REL.: .98

ITEMS STATISTICS: CORRELATION ORDER

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	ITEMS
13	1914	396	.60	.04	2.12	9.9	2.72	9.9	.19	13usa13
12	1372	396	1.39	.04	2.53	9.9	3.06	9.9	.24	12usa12
3	2382	396	-.42	.06	1.92	8.3	2.27	9.9	.26	3usa3
16	2031	396	.40	.04	2.37	9.9	2.70	9.9	.31	16usa16
2	2533	396	-1.00	.07	1.30	3.0	1.64	5.3	.31	2usa2
15	2376	396	-.40	.06	1.86	8.0	1.86	7.8	.31	15usa15
9	1715	396	.91	.04	1.99	9.9	2.64	9.9	.33	9usa9
14	2370	396	-.38	.06	1.88	8.1	1.89	8.1	.34	14usa14
4	2471	396	-.73	.06	1.59	5.7	1.62	5.5	.35	4usa4
6	2498	396	-.84	.07	1.25	2.6	1.37	3.4	.35	6usa6
10	2501	396	-.86	.07	1.55	5.2	1.48	4.3	.36	10usa10
5	2528	396	-.98	.07	1.26	2.6	1.14	1.4	.37	5usa5
11	2291	396	-.16	.05	1.78	7.4	1.84	7.9	.38	11usa11
7	1898	396	.63	.04	1.67	7.9	1.93	9.9	.39	7usa7
8	2197	396	.07	.05	1.62	6.4	1.68	6.9	.39	8usa8
1	1855	396	.70	.04	1.78	9.1	1.91	9.9	.39	1usa1
65	2451	396	-.66	.06	1.53	5.2	2.11	9.1	.41	65int3
66	1890	396	.64	.04	1.45	5.6	1.89	9.6	.42	66int4
64	2487	396	-.80	.06	1.29	3.0	1.30	2.9	.43	64int2
40	2361	396	-.35	.05	1.18	2.0	1.23	2.5	.46	40pu9
53	2365	396	-.37	.06	1.10	1.1	1.08	.9	.47	53csa6
82	1979	396	.50	.04	1.29	3.6	1.36	4.3	.50	82grat10
62	2352	396	-.33	.05	.85	-1.8	.86	-1.7	.51	62csa15
61	2220	396	.02	.05	.99	-.1	1.16	1.8	.51	61csa14
52	2418	396	-.54	.06	.90	-1.2	.87	-1.5	.51	52csa5
51	2366	396	-.37	.06	.77	-2.9	.85	-1.8	.51	51csa4
43	1979	396	.50	.04	1.25	3.1	1.50	5.7	.52	43pul2
77	2300	396	-.18	.05	.98	-.2	.90	-1.1	.52	77grat5
25	2094	396	.29	.04	1.19	2.3	1.26	3.1	.52	25peu9
26	2075	396	.32	.04	1.20	2.4	1.27	3.2	.52	26peu10
29	2004	396	.45	.04	1.16	2.0	1.19	2.4	.52	29peu13
41	2341	396	-.29	.05	.87	-1.5	1.01	.2	.53	41pul0
24	1998	396	.46	.04	1.15	1.9	1.24	2.9	.53	24peu8
46	2271	396	-.10	.05	.91	-1.1	.91	-1.0	.53	46pul5
45	2378	396	-.41	.06	1.03	.4	.96	-.4	.54	45pul4
17	2146	396	.18	.05	.89	-1.3	.91	-1.1	.55	17peu1
67	2343	396	-.30	.05	.90	-1.2	.86	-1.6	.55	67int5
72	2279	396	-.12	.05	.98	-.1	1.00	.1	.55	72int10
27	2142	396	.19	.05	1.11	1.3	1.12	1.5	.55	27peu11
63	2404	396	-.49	.06	.90	-1.2	.84	-1.8	.56	63int1
48	2294	396	-.16	.05	.78	-2.7	.80	-2.4	.57	48csa1
54	2349	396	-.32	.05	.67	-4.3	.68	-4.1	.57	54csa7
68	2310	396	-.21	.05	.84	-1.9	.81	-2.3	.58	68int6
47	2341	396	-.29	.05	.82	-2.2	.79	-2.6	.58	47pul6
71	2279	396	-.12	.05	.91	-1.1	.82	-2.2	.58	71int9
31	2308	396	-.20	.05	.82	-2.2	.78	-2.7	.58	31peu15
50	2318	396	-.23	.05	.65	-4.6	.68	-4.2	.58	50csa3
60	2282	396	-.13	.05	.74	-3.3	.75	-3.2	.58	60csa13
58	2372	396	-.39	.06	.74	-3.2	.68	-4.0	.59	58csa11
18	2099	396	.28	.04	.83	-2.3	.84	-2.1	.59	18peu2
44	2235	396	-.02	.05	.84	-2.0	.84	-1.9	.59	44pul3
69	2321	396	-.24	.05	.81	-2.3	.77	-2.9	.59	69int7
20	1953	396	.54	.04	.81	-2.8	.89	-1.5	.59	20peu4
19	2055	396	.36	.04	.71	-4.2	.75	-3.4	.60	19peu3
42	2229	396	.00	.05	.80	-2.6	.89	-1.3	.60	42pul1
39	2263	396	-.08	.05	.78	-2.7	.75	-3.3	.61	39pu8
59	2333	396	-.27	.05	.57	-5.9	.57	-5.9	.61	59csa12
70	2342	395	-.32	.05	.75	-3.1	.67	-4.3	.61	70int8
49	2280	396	-.13	.05	.60	-5.5	.63	-5.0	.61	49csa2
74	2066	396	.34	.04	.77	-3.1	.79	-2.9	.61	74grat2
56	2263	396	-.08	.05	.58	-5.8	.62	-5.1	.62	56csa9
57	2291	396	-.16	.05	.56	-6.1	.57	-5.9	.62	57csa10
75	2117	396	.24	.04	.75	-3.4	.76	-3.2	.62	75grat3
23	2117	396	.24	.04	.73	-3.8	.76	-3.2	.62	23peu7
78	2074	396	.32	.04	.79	-2.9	.76	-3.3	.62	78grat6
76	2161	396	.15	.05	.71	-3.9	.74	-3.5	.63	76grat4
55	2256	396	-.07	.05	.63	-5.0	.63	-5.0	.63	55csa8
21	2058	396	.35	.04	.74	-3.8	.77	-3.2	.63	21peu5
79	2039	396	.39	.04	.73	-3.8	.71	-4.1	.63	79grat7
30	2064	396	.34	.04	.71	-4.2	.72	-3.9	.64	30peu14
80	2059	396	.35	.04	.70	-4.3	.72	-3.9	.64	80grat8
32	2248	396	-.05	.05	.75	-3.2	.76	-3.1	.64	32pul
81	2165	396	.14	.05	.70	-4.2	.65	-4.8	.64	81grat9
22	1919	396	.60	.04	.75	-3.7	.78	-3.1	.64	22peu6
73	2206	396	.05	.05	.63	-5.1	.65	-4.9	.65	73grat1
37	2201	396	.06	.05	.77	-2.9	.74	-3.4	.66	37pu6
38	2078	396	.32	.04	.73	-3.8	.71	-4.0	.67	38pu7
28	2062	396	.35	.04	.58	-6.4	.60	-5.9	.67	28peu12
33	2200	396	.06	.05	.67	-4.5	.68	-4.4	.68	33pu2
34	2066	396	.34	.04	.62	-5.7	.65	-5.1	.69	34pu3
35	2139	396	.20	.05	.63	-5.3	.63	-5.3	.70	35pu4
36	2113	396	.25	.04	.63	-5.4	.64	-5.2	.70	36pu5
MEAN	2201.	396.	.00	.05	1.03	-.3	1.10	.0		
S.D.	196.	0.	.44	.01	.44	4.6	.56	4.9		

Figure 3.21: Item Polarity Map

According to Bond and Fox (2001), the Rasch model is based on the idea that all persons are more likely to respond correctly to easy items than difficult ones, and all items are more likely to be answered by persons who have a higher ability than a lower one. Figure 3.22 reveals that the map of the valid items is located in their calibrations on a single continuum. As shown on the right hand side of Figure 3.22, the items on this single continuum are structured from the "less difficult to be rated as technology adoption and gratification" to the "more difficult to be rated as technology adoption and gratification" The left hand side of this figure also matches the level of a person's ability in a single line, whereby the respondents are ordered from the "higher level of agreement to endorse lecturers' adoption and gratification with the ICT facilities" to the "lower level agreement to endorse lecturers' adoption and gratification with the ICT facilities". Thus, this study discovered that the most difficult item was *use12* and the least difficult were use2 and use5. Majority of the lecturers elected to use the ICT facilities in higher education as shown in Figure 3.22.

```
TABLE 12.2 TAG MODEL                                ZOU999ws.txt Nov 16 23:14 2014
INPUT: 396 PERSONS, 82 ITEMS  MEASURED: 396 PERSONS, 82 ITEMS, 7 CATS       3.49
--------------------------------------------------------------------------------

       PERSONS MAP OF ITEMS
               <more>|<rare>
    5                +
                     |
                     |
                     |
                     |
                     |
                  .  |
    4             .  +
                     |
                  .  |
                  .  |
                  .  |
                  .  |
                     |
    3             .  +
                  #  |
                     |
                  # T|
                 .#  |
                 ##  |
                 .#  |
    2           .##  +
               .### S|
                .##  |
               .###  |
              .####  |  12use12
             .#####  |
            .######  |
    1      ######## M+
           ########  |T 9use9
      .############  |  1use1
           ########  |  13use13   20peu4    22peu6    66int4    7use7
            #######  |S 16use16   19peu3    24peu8    29peu13   43pu12
                        79grat7   82grat10
           .####### S|  18peu2    21peu5    23peu7    25peu9    26peu10
                        28peu12   30peu14   34pu3     36pu5     38pu7
                        74grat2   75grat3   78grat6   80grat8
               ####  |  17peu1    27peu11   35pu4     76grat4   81grat9
                        8use8
    0          ####  +M 32pu1     33pu2     37pu6     42pu11    44pu13
                        55cse8    61cse14   73grat1
                  .#  |  11use11   31peu15   39pu8     46pu15    48cse1
                        49cse2    56cse9    57cse10   60cse13   68int6
                        71int9    72int10   77grat5
                  .  |  40pu9     41pu10    47pu16    50cse3    54cse7
                        59cse12   62cse15   67int5    69int7    70int8
                  .  |S 14use14   15use15   3use3     45pu14    51cse4
                        53cse6    58cse11   63int1
                  . T|  52cse5
                  .  |  4use4     65int3
                        |T 10use10   64int2    6use6
   -1                   +  2use2     5use5
               <less>|<frequ>
 EACH '#' IS 4.
```

Figure 3.22: Item Map

Item fit order demonstrated that most items showed good item fit and were constructed on a continuum of increasing intensity. However, eight items (use12,

use13, use16, use9, use3, use7, use1 and use14) showing a misfit to the Rasch model had to be removed in order to validate the final questionnaire as shown in Figure 3.23.

TABLE 10.1 TAG MODEL ZOU999wa.txt Nov 16 23:14 2
INPUT: 396 PERSONS, 82 ITEMS MEASURED: 396 PERSONS, 82 ITEMS, 7 CATS 3

PERSON: REAL SEP.: 5.00 REL.: .96 ... ITEM: REAL SEP.: 7.99 REL.: .98

ITEMS STATISTICS: MISFIT ORDER

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.		ITEMS
12	1372	396	1.39	.04	2.53	9.9	3.06	9.9	A	.24	12use12
13	1914	396	.60	.04	2.12	9.9	2.72	9.9	B	.19	13use13
16	2031	396	.40	.04	2.37	9.9	2.70	9.9	C	.31	16use16
9	1715	396	.91	.04	1.99	9.9	2.64	9.9	D	.33	9use9
3	2382	396	-.42	.06	1.92	8.3	2.27	9.9	E	.26	3use3
65	2451	396	-.66	.06	1.43	5.2	1.11	9.1	F	.41	65int3
7	1898	396	.63	.04	1.67	7.9	1.93	9.9	G	.39	7use7
1	1855	396	.70	.04	1.78	9.1	1.91	9.9	H	.39	1use1
14	2370	396	-.38	.06	1.88	8.1	1.89	8.1	I	.34	14use14
66	1890	396	.64	.04	1.45	5.6	1.49	9.6	J	.42	66int4
15	2376	396	-.40	.06	1.46	8.0	1.36	7.8	K	.31	15use15
11	2291	396	-.16	.05	1.48	7.4	1.44	7.9	L	.38	11use11
8	2197	396	.07	.05	1.42	6.4	1.48	6.9	M	.39	8use8
2	2533	396	-1.00	.07	1.30	3.0	1.44	5.3	N	.31	2use2
4	2471	396	-.73	.06	1.49	5.7	1.22	5.5	O	.35	4use4
10	2501	396	-.86	.07	1.45	5.2	1.48	4.3	P	.36	10use10
43	1979	396	.50	.04	1.25	3.1	1.50	5.7	Q	.52	43pul2
6	2498	396	-.84	.07	1.25	2.6	1.37	3.4	R	.35	6use6
82	1979	396	.50	.04	1.29	3.6	1.36	4.3	S	.50	82gsat10
64	2487	396	-.80	.06	1.29	3.0	1.30	2.9	T	.43	64int2
26	2075	396	.32	.04	1.20	2.4	1.27	3.2	U	.52	26peu10
25	2094	396	.29	.04	1.19	2.3	1.26	3.1	V	.52	25peu9
5	2528	396	-.98	.07	1.26	2.6	1.14	1.4	W	.37	5use5
24	1998	396	.46	.04	1.15	1.9	1.24	2.9	X	.53	24peu8
40	2361	396	-.35	.05	1.18	2.0	1.23	2.5	Y	.46	40pu9
29	2004	396	.45	.04	1.16	2.0	1.19	2.4	Z	.52	29peu13
71	2279	396	-.12	.05	.91	-1.1	.82	-2.2		.58	71int9
42	2229	396	.00	.05	.80	-2.6	.89	-1.3		.60	42pul1
20	1953	396	.54	.04	.81	-2.8	.89	-1.5		.59	20peu4
51	2366	396	-.37	.06	.77	-2.9	.85	-1.8		.51	51cse4
68	2310	396	-.21	.05	.84	-1.9	.81	-2.3		.58	68int6
18	2099	396	.28	.04	.83	-2.3	.84	-2.1		.59	18peu2
31	2308	396	-.20	.05	.82	-2.2	.78	-2.7		.58	31peu15
47	2341	396	-.29	.05	.82	-2.2	.79	-2.6		.58	47pul6
69	2321	396	-.24	.05	.81	-2.3	.77	-2.9		.59	69int7
48	2294	396	-.16	.05	.78	-2.7	.80	-2.4		.57	48cse1
74	2066	396	.34	.04	.77	-3.1	.79	-2.9		.61	74gsat2
78	2074	396	.32	.04	.79	-2.9	.76	-3.3		.62	78gsat6
39	2263	396	-.08	.05	.78	-2.7	.75	-3.3		.61	39pu8
22	1919	396	.60	.04	.75	-3.7	.78	-3.1		.64	22peu6
37	2201	396	.06	.05	.77	-2.9	.74	-3.4		.66	37pu6
21	2058	396	.35	.04	.74	-3.8	.77	-3.2		.63	21peu5
23	2117	396	.24	.04	.73	-3.8	.76	-3.2	z	.62	23peu7
75	2117	396	.24	.04	.75	-3.4	.76	-3.2	y	.62	75gsat3
32	2248	396	-.05	.05	.75	-3.2	.76	-3.1	x	.64	32pul
19	2055	396	.36	.04	.71	-4.2	.75	-3.4	w	.60	19peu3
70	2342	395	-.32	.05	.75	-3.1	.67	-4.3	v	.61	70int8
60	2282	396	-.13	.05	.74	-3.3	.75	-3.2	u	.58	60cse13
58	2372	396	-.39	.06	.74	-3.2	.68	-4.0	t	.59	58cse11
76	2161	396	.15	.05	.71	-3.9	.74	-3.5	s	.63	76gsat4
79	2039	396	.39	.04	.73	-3.8	.71	-4.1	r	.63	79gsat7
38	2078	396	.32	.04	.73	-3.8	.71	-4.0	q	.67	38pu7
80	2059	396	.35	.04	.70	-4.3	.72	-3.9	p	.64	80gsat8
30	2064	396	.34	.04	.71	-4.2	.72	-3.9	o	.64	30peu14
81	2165	396	.14	.05	.70	-4.2	.65	-4.8	n	.64	81gsat9
50	2318	396	-.23	.05	.65	-4.6	.68	-4.2	m	.58	50cse3
54	2349	396	-.32	.05	.67	-4.3	.68	-4.1	l	.57	54cse7
33	2200	396	.06	.05	.67	-4.5	.68	-4.4	k	.68	33pu2
73	2206	396	.05	.05	.63	-5.1	.65	-4.9	j	.65	73gsat1
34	2066	396	.34	.04	.62	-5.7	.65	-5.1	i	.69	34pu3
36	2113	396	.25	.04	.63	-5.4	.64	-5.2	h	.70	36pu5
49	2280	396	-.13	.05	.60	-5.5	.63	-5.0	g	.61	49cse2
35	2139	396	.20	.05	.63	-5.3	.63	-5.3	f	.70	35pu4
55	2256	396	-.07	.05	.63	-5.0	.63	-5.0	e	.63	55cse8
56	2263	396	-.08	.05	.58	-5.8	.62	-5.1	d	.62	56cse9
28	2062	396	.35	.04	.58	-6.4	.60	-5.9	c	.67	28peu12
57	2291	396	-.16	.05	.56	-6.1	.57	-5.9	b	.62	57cse10
59	2333	396	-.27	.05	.57	-5.9	.57	-5.9	a	.61	59cse12
MEAN	2201.	396.	.00	.05	1.03	-.3	1.10	.0			
S.D.	196.	0.	.44	.01	.44	4.6	.56	4.9			

Figure 3.23: Item Fit Order

Table 3.9: The Valid Items Measuring Perceived Ease of Use (PEU), Perceived Usefulness (PU), Computer Self-Efficacy (CSE), Intention to Use (INT), Actual Use (USE) and Gratification (GRAT)

Constructs		The List of the Valid Items
PEU	PEU1	I find the university ICT facilities easy to use.
	PEU2	I find it easy to access the university research databases.
	PEU3	It is easy for me to become skilful at using university databases for conducting research.
	PEU4	Interacting with the research databases system requires minimal effort on my part.
	PEU5	I find it easy to get the research databases to help facilitate my research.
	PEU6	Interacting with the university research databases system is very stimulating for me.
	PEU7	I find it easy to select articles/journals of different categories using research databases (Education/Engineering/Business, etc.).
	PEU8	With Wireless Internet, I find it easy to access university databases to do research.
	PEU9	Wireless Internet allows me to access research and learning materials from Web Browser (WWW).
	PEU10	Wireless Internet is easy to use for teaching and research.
	PEU11	I find it easy to use computers provided by the university.
	PEU12	My interaction with university ICT services available is clear and understandable.
	PEU13	I find it easy to download teaching, learning and research materials using Wireless Internet in terms of speed.
	PEU14	It is easy for me to use multimedia facilities at the university.
	PEU15	I find it easy to use Microsoft office for teaching and research purposes.
PU	PU1	Using the ICT facilities at the university enables me to accomplish tasks more quickly.
	PU2	Using the ICT services available at the university increases my research productivity.
	PU3	The current university ICT system makes work more interesting.
	PU4	ICT facilities at the university improve the quality of the work I do.
	PU5	Using the university ICT facilities enhances my research skills.
	PU6	Using the university ICT facilities would make it easier for me to find information.
	PU7	ICT services at the university make information always available to users.
	PU8	Using the ICT facilities helps me write my journal articles.
	PU9	My job would be difficult to perform without the ICT facilities.

Table 3.9, continued

PU	PU10	Using the ICT facilities saves my time.
	PU11	Using the university ICT facilities provides me with the latest information on specific areas of research.
	PU12	I can use ICT facilities from anywhere, anytime at the campus.
	PU13	I believe that the use of ICT in the classroom enhances student learning in my discipline.
	PU14	I believe that email and other forms of electronic communication are important tools in faculty/student communication.
	PU15	I believe that web-based instructional materials enhance student learning.
	PU16	Using the ICT services enables me to download teaching, learning and research materials from the internet.
CSE	CSE1	I have the skills required to use computer applications for writing my research papers.
	CSE2	I have the skills and knowledge required to use computer applications for demonstrating specific concepts in class.
	CSE3	I have the skills required to use computer applications for presenting lectures.
	CSE4	I have the skills required to communicate electronically with my colleagues and students.
	CSE5	I have the ability to e-mail, chat, download teaching, learning and research materials, and search different websites.
	CSE6	I have the ability to use the Wireless Internet service provided by the university.
	CSE7	I have the skills required to use ICT facilities to enhance the effectiveness of my teaching, learning and research.
	CSE8	I feel capable of using the university research databases for writing journal papers.
	CSE9	I have the ability to navigate my way through the ICT facilities.
	CSE10	I have the skills required to use the ICT facilities to enhance the quality of my research works.
	CSE11	I have the ability to save and print journals/articles from the research databases.
	CSE12	I have the knowledge and skills required to benefit from using the university ICT facilities.
	CSE13	I am capable of accessing the research databases from the university website.
	CSE14	I am capable to download and install research related software using ICT facilities at the university.
	CSE15	I am capable of using multimedia facilities for delivering lecturers.

Table 3.9, continued

INT	INT1	I will use the ICT facilities to carry out my research activities.
	INT2	I will use computer applications to present lecture materials in class.
	INT3	I will use Microsoft office applications to write my research papers.
	INT4	I will teach a course that will be delivered totally on the world wide web.
	INT5	I intend to use ICT facilities for teaching, learning and research purposes frequently.
	INT6	I intend to download research materials from the university databases frequently.
	INT7	I will use the university research databases to update myself on the research areas I am pursuing.
	INT8	I intend to use the ICT facilities to upgrade my research performance.
	INT9	I will use the university research databases to write outstanding journal articles.
	INT10	I intend to use research related software to analyze the data.
USE	USE2	How often do you use the following ICT facilities for research and academic-related activities? - Laptop or Desktop computers
	USE4	How often do you use the following ICT facilities for research and academic-related activities? - Web browser (www)
	USE5	How often do you use the following ICT facilities for research and academic-related activities? - Search engine (e.g. Google, Yahoo, etc.).
	USE6	How often do you use the following ICT facilities for research and academic-related activities? - Microsoft Office applications.
	USE8	How often do you use the following ICT facilities for research and academic-related activities? - Document processing (e.g. PDF).
	USE10	How often do you use the following ICT facilities for research and academic-related activities? - Email.
	USE11	How often do you use the following ICT facilities for research and academic-related activities? - Document editing/composing.
	USE15	I use ICT facilities for making presentations in the course
	GRAT1	Overall I am satisfied with the ease of completing my task using ICT facilities.
	GRAT2	I am satisfied with the ICT facilities provided by the university.

Table 3.9, continued

GRAT3	I am satisfied with the ease of use of the ICT facilities.
GRAT4	The university ICT facilities have greatly affected the way I search for information and conduct my research.
GRAT5	Providing the ICT is an indispensable services provided by the university.
GRAT6	Overall I am satisfied with the amount of time it takes to complete my task.
GRAT7	I am satisfied with the structure of accessible information (available as categories of research domain, or by date of issue—of journals in particular, or as full-texts or abstracts of theses and dissertations) of the university research databases.
GRAT8	I am satisfied with the support information provided by the university's ICT facilities.
GRAT9	I am satisfied in using ICT facilities for teaching, learning and research.
GRAT10	Overall I am satisfied with the Wireless Internet service provided at the university.

This study revealed that the variance explained by the measures was 55.3% which demonstrated that the items were able to endorse the University of Malaya and Jiaxing University lecturers' adoption of and gratification in using ICT facilities in higher education for their teaching and research purposes as shown in Figure 3.24.

```
TABLE 23.2 TAG MODEL                              ZOU999ws.txt Nov 16 23:14 2014
INPUT: 396 PERSONS, 82 ITEMS  MEASURED: 396 PERSONS, 82 ITEMS, 7 CATS       3.49
-------------------------------------------------------------------------------

       PRINCIPAL COMPONENTS (STANDARDIZED RESIDUAL) FACTOR PLOT
       Factor 1 extracts 9.5 units out of 82 units of ITEM residual variance noise.
       Yardstick (variance explained by measures)-to-This Factor ratio: 10.7:1
       Yardstick-to-Total Noise ratio (total variance of residuals): 1.2:1

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)
                                            Empirical    Modeled
Total variance in observations     =        183.4  100.0%  100.0%
Variance explained by measures     =        101.4   55.3%   57.3%
Unexplained variance (total)       =         82.0   44.7%   42.7%
Unexpl var explained by 1st factor =          9.5    5.2%

      -2              -1               0               1               2
      ++---------------+---------------+---------------+---------------++
   .7 +                                |                                +
      |                       A   D  BC|                                |
   .6 +                          E GF  |                                +
      |                          JI  H |                                |
F  .5 +                             K  |                                +
A     |                               L|                                |
C  .4 +                          M     |                                +
T     |                 P       O  QN  |                                |
O  .3 +                   RT          S |                                +
R     |                   V       ZY XW U                                |
   .2 +                     1 1    11 2 |                                +
1     |                  1          21   |1                               |
   .1 +                                |                                +
L     |                            1   1111     1                       |
O  .0 +------------------------------1--|---------11----------------------+
A     |                                |        1    1                  |
D -.1 +                               11                                +
I     |                               1|      1 1                       |
N -.2 +                                |z  1    1           1           +
G     |                                | xy w                           |
  -.3 +                                |suqprvt                         +
      |                                |  m oln                         |
  -.4 +                                |   gkji  h                      +
      |                                |    de f                        |
  -.5 +                                |    acb                         +
      ++---------------+---------------+---------------+---------------++
      -2              -1               0               1               2
                              ITEM MEASURE
```

Figure 3.24: Principal Components

3.5 DATA ANALYSIS PROCEDURES

The data analysis procedures involved in the study included the use of descriptive statistics using SPSS version 22. The specific purpose of RASCH analysis was to develop and validate the psychometric properties of TAG model. As such, the questionnaire's reliability and validity were established through a RASCH analysis applying Winsteps version 3.49. This present study also applied the three-stage of the structural equation modeling (SEM), namely, confirmatory factor analysis (CFA),

full-fledged structural model and invariance analysis (metric and configural invariance analyses) to develop and validate the Technology Adoption and Gratification (TAG) model in a cross-culture that addressed the objectives of the study. In order to analyse the causal relationships among the various constructs, AMOS software version 18.0 was applied. Furthermore, the structural aspects of the validity are specially addressed in the validation of the TAG model. Finally, a Sobel test was also conducted to examine the indirect relationships between the constructs of the TAG model.

3.6 STRUCTURAL EQUATION MODELING (SEM)

Structural Equation Modeling (SEM) is one of the statistical models that seek to validate, extend and propose new theories. Primarily, this study used the Structural Equation Modeling (SEM) techniques to validate the measurement models and estimate the fit of the hypothesized and revised models to the survey data. Specifically, the three-step Structural Equation Modeling, involving Confirmatory Factor Analysis (CFA), a Full-fledged Structural model and invariance analysis, were performed to develop and validate the Technology Adoption and Gratification (TAG) model, and to explain the cross-cultural validation in higher education. The hypothesized Structural Equation Model (SEM) for the study is shown in Figure 3.25.

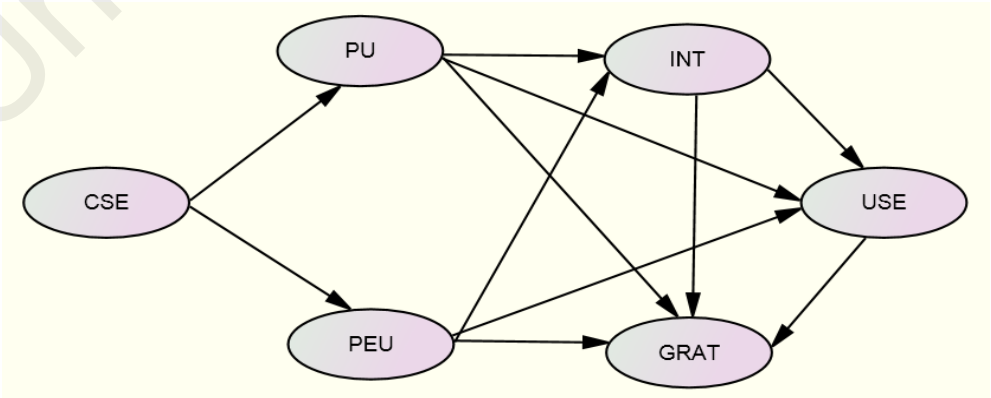

Figure 3.25: The Hypothesized Technology Adoption and Gratification (TAG) Model

3.7 MODEL EVALUATION

In order to analyze the structural relationships among the various constructs, namely, *computer self-efficacy, perceived ease of use*, *perceived usefulness*, *intention to use, use* and *gratification*, the analysis used the greatest probability estimation in generating estimates of the six Confirmatory Factor Analysis (CFA) models and Full-fledged structural equation model. In other words, the models were estimated by applying a set of measures to assess the goodness-of-fit of each model. The goodness-of-fit measures, guided by the universally accepted criteria for deciding good fit, assessed the (i) reliability of the hypothesized model with the observed data, (ii) justifications of variability, (iii) fairness of the estimates, and (iv) simplicity of the measured models. The adequacy of the model was determined using five measures of good fit. The first Chi-square ($\chi 2$) measured the compatibility of the data with the hypothesized model. The chi-square value divided ($\chi 2/df$) by the degree of freedom value should be less than or equal to 3.0. Second, the Root Mean Square Error of Approximation (RMSEA) measures the intimacy of model fit, and should be less than .08. Third, the Comparative Fit Index (CFI) evaluates the fit of the existing model with a null model that predicts the latent variables to be uncorrelated in the model. The value of the CFI should be greater than or equal to 0.90. Fourth, the Goodness of Fit Index (GFI), which deals with error in imitating the variance-covariance matrix, must be greater than .90 to indicate good fit. Finally, the Tucker-Lewis Index (TLI) measures the estimated model against the null-model, and should display a value of .90 or more to show good fit of the model. The summary of the goodness-of-fit indices is shown in Table 310.

Table 3.10: The Recommended Goodness-of-Fit Indices

Fit Indices	Recommended
Chi-square ($\chi 2$)	Non-significant
p value	$\geq .05$
RMSEA	$\leq .08$
CFI	$\geq .90$
TLI	$\geq .90$

CHAPTER 4

RESULTS

4.1 INTRODUCTION

This chapter presents the findings of this study. The data were examined to discover the causal relationships of the Technology Adoption and Gratification (TAG) model between the University of Malaya (UM) and Jiaxing University (JU) lecturers' adoption and gratification in using ICT facilities and the constructs of: *computer self-efficacy, perceived ease of use*, *perceived usefulness*, *intention to use, actual use* and *gratification.* Thus, A 3-step Structural Equation Modeling (SEM) approach was adopted. Section 1 demonstrates the results of validating the Confirmatory Factor Analysis (CFA) for 6 measurement models, namely, *computer self-efficacy, perceived ease of use*, *perceived usefulness*, *intention to use, actual use* and *gratification*. Section 2 displays the estimation of the full-fledged structural model of TAG. Section 3 shows the cross-cultural validation of the TAG model using invariance analyses. Moreover, the measurement models were evaluated, followed by an explanation of the full-fledged Structural Equation Modeling (SEM) as well as cross-cultural-invariant.

SECTION 1: VALIDATING THE CONFIRMATORY FACTOR ANALYSIS MODELS

4.2 ONE-FACTOR MEASUREMENT MODEL OF PERCEIVED EASE OF USE (PEU)

The specific objective was to measure the lecturers' views on the ease of use of ICT facilities for their teaching and research purposes in higher education. To address the objective 2, the present study conducted a Confirmatory Factor Analysis (CFA) to

confirm lecturers' perceptions on the ease of use and to test the impact of perceived ease of use in the hypothesized TAG model; hypotheses 2 and 9 were evaluated. The preliminary CFA model was performed on 15 items that explain the factor of perceived ease of use. The majority of the standardized factor loadings were greater than .70, with only few items demonstrating loadings ranging from .57 to .69. Nevertheless, the findings of one-factor measurement model of perceived ease of use discovered that the overall fit indices did not fulfill the statistical requirements as indicated by the following fit indices: $\chi 2$ (df = 90) = 1152.997; p = 0.000; RMSEA = 0.173; CFI = 0.723; TLI = 0.677; SRMR = 0.185 (see Appendix C). As a result, the model required revision due to the violations and estimation. After deleting these items (PEU1 PEU3, PEU5, PEU8, PEU10, PEU11, PEU12, PEU13 and PEU14), the analysis demonstrated an exceptional goodness-of-fit of the model. The items were removed one at a time according to their modification indices, with the largest being removed first, which showed the presence of multiple collinearity as shown in Table 4.1.

Table 4.1: The List of Removed Items

Item Deleted	Chi-square ($\chi 2$)	*df*	*p* value	RMSEA	CFI	TLI	SRMR
PEU1	1060.716	77	.000	.180	.724	.674	.189
PEU3	932.028	65	.000	.184	.729	.675	.181
PEU5	746.723	54	.000	.180	.749	.694	.175
PEU8	513.111	44	.000	.164	.791	.739	.159
PEU10	267.821	35	.000	.130	.872	.835	.119
PEU11	216.366	27	.000	.133	.882	.842	.119
PEU12	204.390	20	.000	.153	.862	.806	.132
PEU13	66.497	14	.000	.097	.950	.924	.071
PEU14	19.151	9	.024	.053	.987	.979	.043

The following 6 items remained in the original pool of 15 items: PEU2, PEU4, PEU6, PEU7, PEU9 and PEU15. These items were used as the indicators for the one-

factor measurement model of perceived ease of use. The Figure 4.1 shows the error variances in the model represented by e2, e4, e6, e7, e9 and e15.

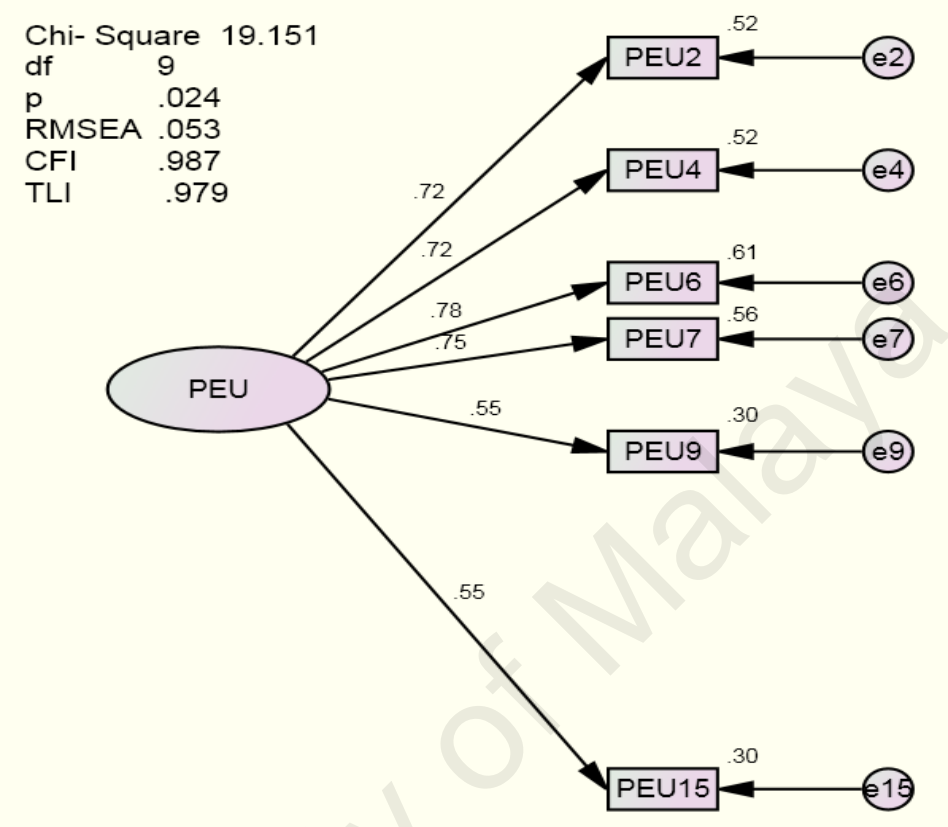

Figure 4.1: One-Factor Measurement Model for Perceived Ease of Use

The results of the model's overall goodness-of-fit statistics showed an exceptional fit; the model chi-square, $\chi 2$ (df=9) =19.151, p=.024 and the root mean square error of approximation (RMSEA) represented a goodness-of-fit of the model with a satisfactory value of .053; the value of the comparative fit index (CFI) was .987; the Tucker-Lewis index (TLI) value was .979 and the value of the standardized root mean square residual (SRMR) was .043. The CFA model fit indices were supported by prior studies (Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). The results in Figure 4.1 indicate that the parameters were free from offending estimates. The standardized factor demonstrated loadings ranging from .55 to .78, representing statistically significant indicators. The item loadings are shown in Table 4.2.

Table 4.2: The Loadings for Perceived Ease of Use

Item No	Item label	Loadings	*M*	*SD*	α
PEU2	I find it easy to access the university research databases.	.72	5.300	1.313	
PEU4	Interacting with the research databases system requires minimal effort on my part.	.72	4.931	1.366	
PEU6	Interacting with the university research databases system is very stimulating for me.	.78	4.846	1.388	
PEU7	I find it easy to select articles/journals of different categories using research databases (Education/Engineering/Business, etc.).	.75	5.346	1.246	.833
PEU9	Wireless Internet allows me to access research and learning materials from Web Browser (WWW).	.55	5.287	1.486	
PEU15	I find it easy to use Microsoft office for teaching and research purposes.	.55	5.828	1.123	

The findings of the one-factor measurement model of perceived ease of use also revealed that the lecturers' views on the ease of use of ICT facilities were indicated by six valid predictors. They explained approximately 46.7% of the variability of lecturers' perceived ease of use of ICT facilities for their teaching and research purposes in higher education as represented in Table 4.3.

Table 4.3: The Squared Multiple Correlations

Items Measured	
PEU2	.524
PEU4	.515
PEU6	.609
PEU7	.558
PEU9	.301
PEU15	.299
The average total variance	0.467

4.3 ONE-FACTOR MEASUREMENT MODEL OF PERCEIVED USEFULNESS (PU)

The specific objective was to evaluate the lecturers' perception regarding the usefulness of ICT facilities in higher education. To address the objective 3, this study performed a Confirmatory Factor Analysis (CFA) to confirm lecturers' perceptions on the usefulness of ICT facilities for their teaching and research purposes and to examine the influence of perceived usefulness in the hypothesized TAG model, hypotheses 3 and 9 were tested. The initial CFA model was estimated with 16 indicators of perceived usefulness. All items exhibited a loading greater than .70 on their respective factor. However, the results of the one-factor measurement model of perceived usefulness exhibited that the overall fit indices were not adequate as indicated by the following fit indices: $\chi 2$ (df = 104) = 1217.231; p = 0.000; RMSEA = 0.165; CFI = 0.783; TLI = 0.750; SRMR = 0.137. Thus, 9 items were dropped due to violations and estimation (see Appendix B). After deleting these items (PU1, PU8, PU9, PU10, PU12, PU13, PU14, PU15 and PU16), the overall fit indices showed an adequate fit. The items were removed one at a time according to their modification indices, with the largest being removed first, which showed the presence of multiple collinearity as indicated in Table 4.4.

Table 4.4: The List of Removed Items

Item Deleted	Chi-square ($\chi 2$)	*df*	*p* value	RMSEA	CFI	TLI	SRMR
PU1	1090.810	90	.000	.168	.784	.748	.141
PU8	1005.069	77	.000	.175	.784	.745	.147
PU9	783.672	65	.000	.167	.819	.783	.137
PU10	653.472	54	.000	.168	.837	.801	.136
PU12	573.215	44	.000	.174	.848	.810	.136
PU13	444.767	35	.000	.172	.870	.833	.124
PU14	216.395	27	.000	.133	.933	.910	.084
PU15	91.114	20	.000	.095	.973	.962	.049
PU16	44.929	14	.000	.075	.987	.981	.032

Eventually, only seven items were selected for this model; they were: PU2, PU3, PU4, PU5, PU6, PU7 and PU11. These items were used as the indicators for the one-factor measurement model of *perceived usefulness* with e2, e3, e4, e5, e6, e7 and e11 representing error variances. This is shown in Figure 4.2.

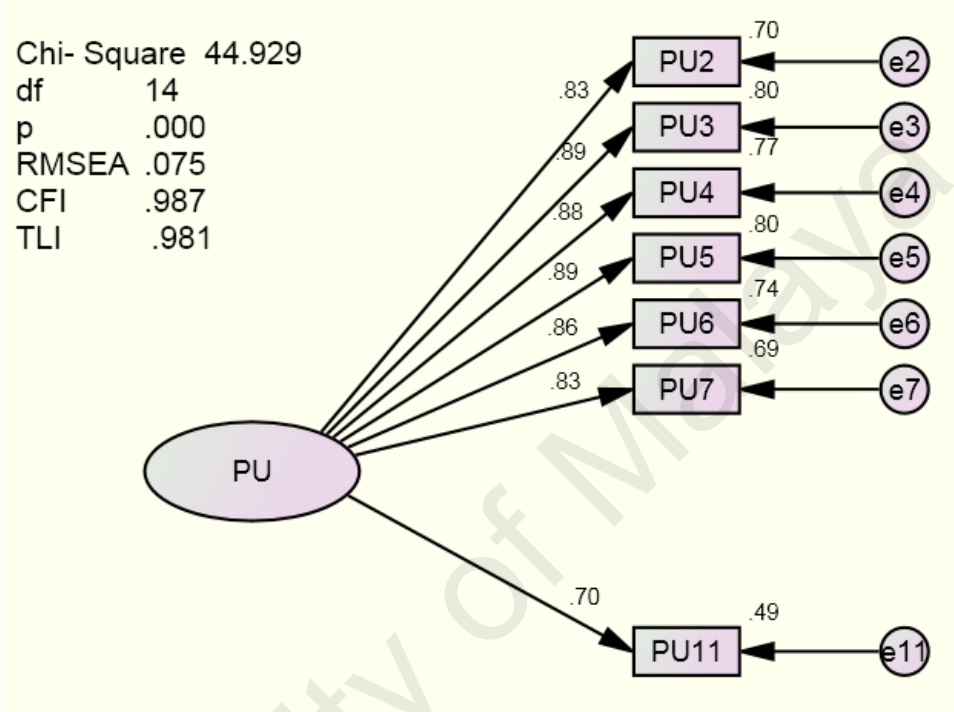

Figure 4.2: One-Factor Measurement Model for Perceived Usefulness

The model's overall goodness-of-fit statistics showed a satisfactory fit; the model chi-square, $\chi 2$ (*df*=14) =44.929, *p*=.000 and the root mean square error of approximation (RMSEA) signified an adequacy of the model with a value of .075; the value of the comparative fit index (CFI) was .987; the Tucker-Lewis index (TLI) value was .981 and the value of the standardized root mean square residual (SRMR) was .032. The overall CFA model fit indices were supported by previous studies (Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). The results in Figure 4.6 exhibit that the items were free from offending estimates. The standardized factor established loadings ranging from .70 to .89, indicating statistically significant indicators. The

item loadings are shown in Table 4.5.

Table 4.5: The Loadings for Perceived-Usefulness Items

Item No	Item label	Loadings	*M*	*SD*	α
PU2	Using the ICT services available at the university increases my research productivity.	.83	5.555	1.270	
PU3	The current university ICT system makes work more interesting.	.89	5.217	1.324	
PU4	ICT facilities at the university improve the quality of the work I do.	.88	5.401	1.289	
PU5	Using the university ICT facilities enhances my research skills.	.89	5.335	1.285	
PU6	Using the university ICT facilities would make it easier for me to find information.	.86	5.558	1.304	.944
PU7	ICT services at the university make information always available to users.	.83	5.247	1.379	
PU11	Using the university ICT facilities provides me with the latest information on specific areas of research.	.70	5.628	1.226	

The results of the one-factor measurement model of perceived usefulness also discovered that the lecturers' perceptions on the usefulness of ICT facilities for their teaching and research purposes in higher education were demonstrated by seven valid predictors. They explained almost 71.1% of the variability of lecturers' perceived usefulness of ICT facilities as shown in Table 4.6.

Table 4.6: The Squared Multiple Correlations

Items Measured	
PU2	.696
PU3	.799
PU4	.774
PU5	.796
PU6	.736
PU7	.688
PU11	.489
The average total variance	0.711

4.4 ONE-FACTOR MEASUREMENT MODEL OF COMPUTER SELF-EFFICACY (CSE)

The specific objective was to examine the lecturers' computer self-efficacy to access ICT facilities in higher education for their teaching and research purposes. To address the objective 4, the current study conducted Confirmatory Factor Analysis (CFA) to assess the lecturers' perceptions on their computer self-efficacy of ICT use and to evaluate the effect of computer self-efficacy in the hypothesized TAG model, hypotheses 1, 6, 7 and 8 were estimated. The original CFA model was estimated with 15 items of computer self-efficacy. All items demonstrated a loading greater than .59 on their respective factor. However, the findings of the one-factor measurement model of computer self-efficacy revealed that the overall fit indices did not execute the statistical requirements as indicated by the following fit indices: $\chi 2$ (df = 90) = 834.732; p = 0.000; RMSEA = 0.145; CFI = 0.861; TLI = 0.838; SRMR = 0.067. As such, 8 items were removed due to violations and estimation (see Appendix A). After deleting these items (CSE1, CSE2, CSE3, CSE5, CSE6, CSE8, CSE13 and CSE14), the analysis showed a goodness-of-fit of the model. The items were removed one at a time according to their modification indices, with the largest being removed first, which showed the presence of multiple collinearity as shown in Table 4.7.

Table 4.7: The List of Removed Items

Item Deleted	Chi-square ($\chi 2$)	*df*	*p* value	RMSEA	CFI	TLI	SRMR
CSE1	663.238	77	.000	.139	.880	.858	.062
CSE2	568.268	65	.000	.140	.885	.863	.062
CSE3	427.488	54	.000	.132	.904	.883	.060
CSE5	266.433	44	.000	.113	.934	.918	.057
CSE6	217.543	35	.000	.115	.942	.925	.059
CSE8	170.934	27	.000	.116	.947	.930	.061
CSE13	48.627	20	.000	.060	.988	.983	.028
CSE14	20.893	14	.104	.035	.997	.995	.012

The items that remained were: CSE4, CSE7, CSE9, CSE10, CSE11, CSE12 and CSE15. These items were used as the indicators for the one-factor measurement model of computer self-efficacy. Figure 4.3 shows the error variances in the model represented by e4, e7, e9, e10, e11, e12 and e15.

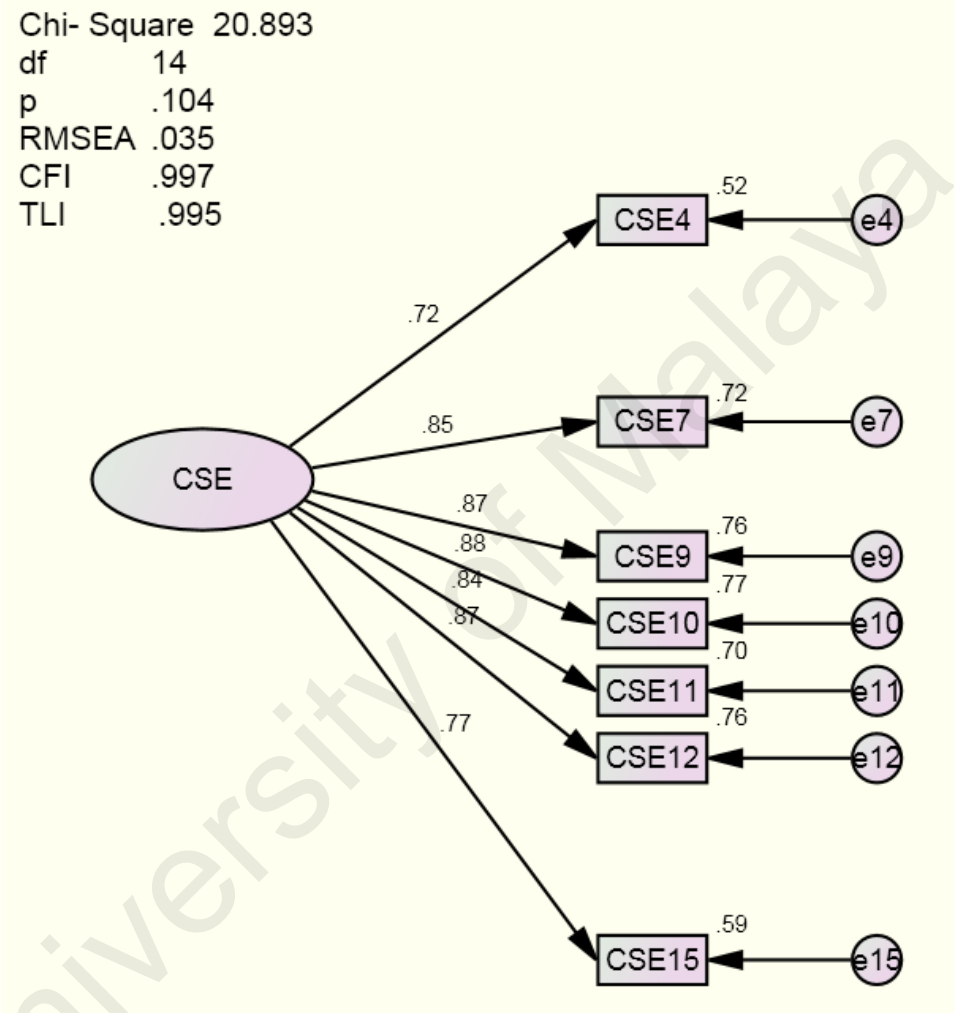

Figure 4.3: One-Factor Measurement Model for Computer Self-efficacy

The model's overall goodness-of-fit statistics showed excellent fit; the model chi-square was statistically non-significant, $\chi 2$ (*df*=14) =20.893, *p*=.104 and the root mean square error of approximation (RMSEA) indicated the model's adequacy at an acceptable value of .035. The value of the comparative fit index (CFI) was .997; the Tucker-Lewis index (TLI) value was .995 and the value of the standardized root mean

square residual (SRMR) was .012. The overall CFA model fit indices were recommended by earlier researchers (Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). The results in Figure 4.3 show that the parameters were free from offending estimates. The standardized factor demonstrated loadings ranging from .72 to .88, indicating statistically significant indicators. The item loadings are shown in Table 4.8.

Table 4.8: The Loadings for Computer Self-efficacy

Item No	Item label	Loadings	*M*	*SD*	α
CSE4	I have the skills required to communicate electronically with my colleagues and students.	.72	5.974	.988	
CSE7	I have the skills required to use ICT facilities to enhance the effectiveness of my teaching, learning and research.	.85	5.931	.984	
CSE9	I have the ability to navigate my way through the ICT facilities.	.87	5.714	1.051	
CSE10	I have the skills required to use the ICT facilities to enhance the quality of my research works.	.88	5.785	.009	.938
CSE11	I have the ability to save and print journals/articles from the research databases.	.84	5.989	1.016	
CSE12	I have the knowledge and skills required to benefit from using the university ICT facilities.	.87	5.891	.955	
CSE15	I am capable of using multimedia facilities for delivering lecturers.	.77	5.939	1.029	

The findings of the one-factor measurement model of computer self-efficacy also exhibited that the lecturers' views on the computer self-efficacy of ICT usage were indicated by seven valid predictors. They explained approximately 68.8% of the variability of lecturers' computer self-efficacy of ICT usage for their teaching and research purposes in higher education as shown in Table 4.9.

Table 4.9: The Squared Multiple Correlations

Items Measured	
CSE4	.517
CSE7	.721
CSE9	.760
CSE10	.771
CSE11	.699
CSE12	.763
CSE15	.586
The average total variance	0.688

4.5 ONE-FACTOR MEASUREMENT MODEL OF INTENTION TO USE (INT)

The specific objective was to examine the lecturers' intention to use of ICT facilities for their teaching and research purposes in higher education. To address the objective 5, the present study performed a Confirmatory Factor Analysis (CFA) to measure the lecturers' perceptions on their intention to use of ICT facilities and to determine the impact of intention to use in the hypothesized TAG model, hypotheses 4 and 10 were tested. The primary CFA model was estimated with 10 items of intention to use. The majority of the items exhibited a loading greater than .63 on their respective factor. The majority of the standardized factor loadings were greater than .63, with only two items demonstrating loadings ranging from .32 to .40 (INT4 and INT8). However, the results of the one-factor measurement model of intention to use showed that the overall fit indices did not confirm a satisfactory fit to the data as indicated by the following fit indices: $\chi 2$ (df = 35) = 269.468; p = 0.000; RMSEA = 0.130; CFI = 0.892; TLI = 0.861; SRMR = 0.083. Thus, the researcher dropped items: INT4, INT6 and INT9 due to violations and estimation (see Appendix D). After deleting these items, the analysis showed a goodness-of-fit of the model. The items were removed one at a time according to their modification indices, with the largest being removed first,

which showed the presence of multiple collinearity as shown in Table 4.10.

Table 4.10: The List of Removed Items

Item Deleted	Chi-square ($\chi 2$)	*df*	*p* value	RMSEA	CFI	TLI	SRMR
INT4	235.920	27	.000	.140	.900	.866	.070
INT6	162.597	20	.000	.134	.912	.876	.070
INT9	55.478	14	.000	.087	.966	.949	.069

Eventually, only seven items were taken, namely: INT1, INT2, INT3, INT5, INT7, INT8 and INT10. These items were used as the indicators for the one-factor measurement model of Intention to Use. Figure 4.14 shows the error variances in the model represented by e1, e2, e3, e5, e7, e8, and e10.

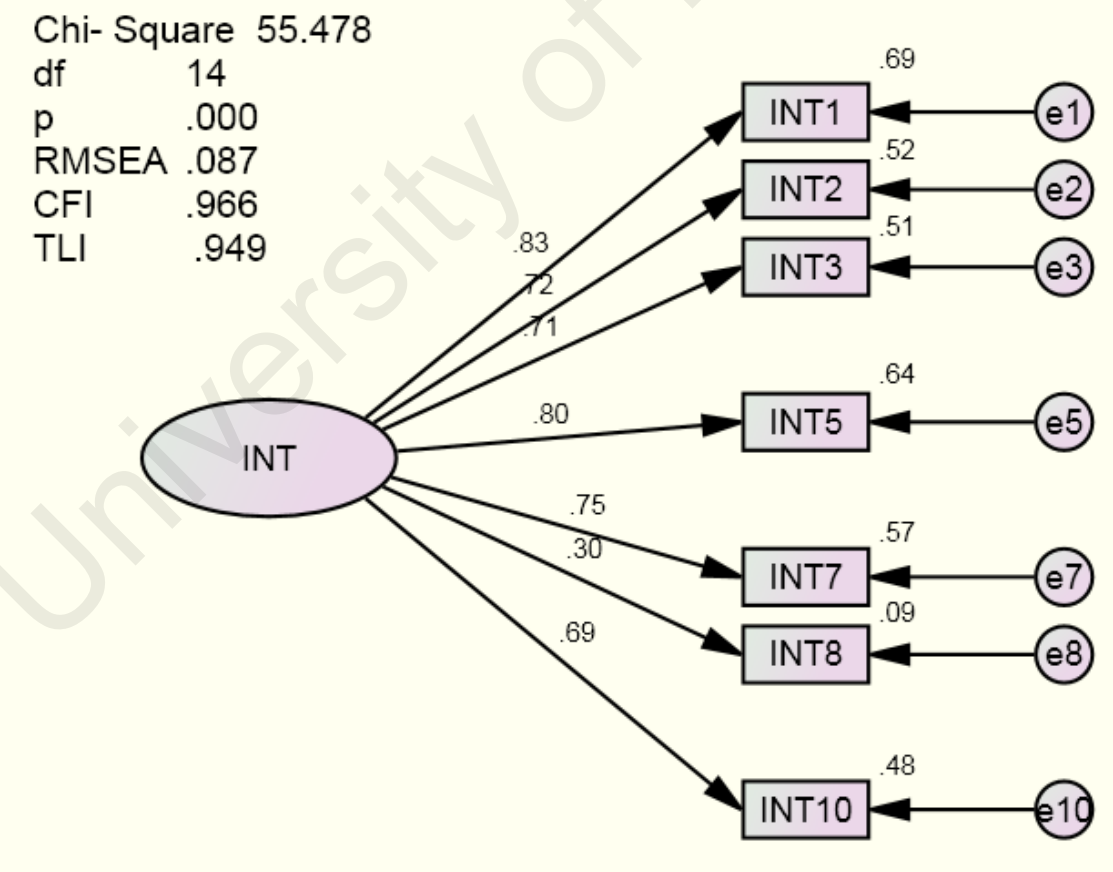

Figure 4.4: One-Factor Measurement Model for Intention to Use

The model's overall goodness-of-fit statistics demonstrated an adequate fit; the model chi-square, $\chi 2$ (df=14) =55.478, p=.000 and the root mean square error of approximation (RMSEA) showed the model's adequacy with an acceptable value of .087; the value of the comparative fit index (CFI) was .966; the Tucker-Lewis index (TLI) value was .949 and the value of the standardized root mean square residual (SRMR) was .069. The CFA model fit indices were supported by prior studies (Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). The majority of the items standardized factor demonstrated loadings ranging from .69 to .83, indicating statistically significant indicators. The only exception was the sixth item (INT8) which had a loading of .30. This loading was supported by Hair et al., (2010). The results in Figure 4.4 show that the parameters were free from offending estimates. The item loadings are shown in Table 4.11.

Table 4.11: The Loadings for Intention-to-Use Items

Item No	Item label	Loadings	*M*	*SD*	∝
INT1	I will use the ICT facilities to carry out my research activities.	.83	6.070	1.038	
INT2	I will use computer applications to present lecture materials in class.	.72	6.280	1.001	
INT3	I will use Microsoft office applications to write my research papers.	.71	6.189	1.157	
INT5	I intend to use ICT facilities for teaching, learning and research purposes frequently.	.80	5.916	1.104	.700
INT7	I will use the university research databases to update myself on the research areas I am pursuing.	.75	5.861	1.092	
INT8	I intend to use the ICT facilities to upgrade my research performance.	.30	6.108	3.724	
INT10	I intend to use research related software to analyze the data.	.69	5.755	1.221	

The results of the one-factor measurement model of intention to use also confirmed that the lecturers' perceptions on the intention to use of ICT facilities were demonstrated by seven valid predictors. They explained almost 50% of the variability of lecturers' intention to use of ICT facilities for their teaching and research purposes in higher education as shown in Table 4.12.

Table 4.12: The Squared Multiple Correlations

Items Measured	
INT1	.691
INT2	.524
INT3	.506
INT5	.638
INT7	.570
INT8	.093
INT10	.478
The average total variance	0.50

4.6 ONE-FACTOR MEASUREMENT MODEL OF USE (USE)

The specific objective was to determine the lecturers' actual use of ICT facilities for their teaching and research purposes in higher education. To address the objective 6, this study analyzed Confirmatory Factor Analysis (CFA) to examine the lecturers' views on their actual use of ICT facilities and to measure the effect of use in the hypothesized TAG model, hypotheses 5 was estimated. The initial CFA model was tested for the factor of use by 16 items. Most items demonstrated a loading greater than .56 on their particular factor. However, few items indicated a loading smaller than the recommended value (see Appendix E). Subsequently, the findings of the one-factor measurement model of use exhibited that the overall fit indices did not show a satisfactory fit to the data as indicated by the following fit indices: $\chi 2$ (df = 104) = 875.902; p = 0.000; RMSEA = 0.137; CFI = 0.644; TLI = 0.589; SRMR = 0.293. As a

result, the initial model required revision due to violations and estimation. After removing 11 items (USE1, USE3, USE7, USE8, USE9, USE10, USE12, USE13, USE14, USE15 AND USE16), the measurement model executed the statistical requirements. The items were removed one at a time according to their modification indices, with the largest being removed first, which showed the presence of multiple collinearity as shown in Table 4.13.

Table 4.13: The List of Removed Items

Item Deleted	Chi-square (χ2)	*df*	*p* value	RMSEA	CFI	TLI	SRMR
USE1	833.444	90	.000	.145	.642	.582	.305
USE3	792.271	77	.000	.153	.642	.577	.319
USE7	647.096	65	.000	.151	.680	.616	.291
USE8	562.157	54	.000	.154	.689	.620	.303
USE9	480.960	44	.000	.159	.715	.644	.258
USE10	436.691	35	.000	.170	.692	.604	.281
USE12	359.946	27	.000	.177	.730	.640	.214
USE13	319.156	20	.000	.195	.749	.648	.205
USE14	107.751	14	.000	.130	.893	.840	.174
USE15	18.893	9	.026	.053	.986	.977	.078
USE16	8.475	5	.132	.042	.995	.990	.024

The following 5 items (USE2, USE4, USE5, USE6 and USE11) were used as the indicator for the one-factor measurement model of *use*. Figure 4.5 shows the error variances in the model represented by e2, e4, e5, e6 and e11.

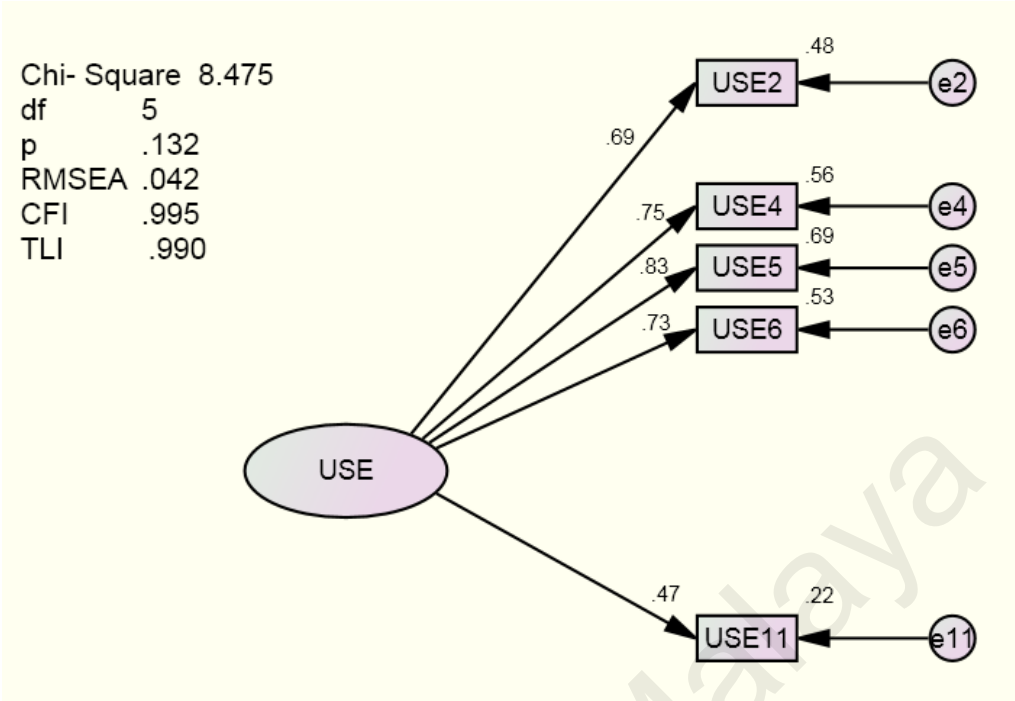

Figure 4.5: One-Factor Measurement Model for Use

The model's overall goodness-of-fit statistics indicated a satisfactory fit; the model chi-square was statistically non-significant, $\chi 2$ (*df*=5) =8.475, *p*=.132 and the root mean square error of approximation (RMSEA) showed an adequate fit with a value of .042. The value of the comparative fit index (CFI) was .995; the Tucker-Lewis index (TLI) value was .990 and the value of the standardized root mean square residual (SRMR) was .024. The CFA model fit indices were supported by previous researchers (Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). The results in Figure 4.5 exhibit that the items were free from offending estimates. The standardized factor established loadings ranging from .47 to .83, representing statistically significant indicators. The item loadings are shown in Table 4.14.

Table 4.14: The Loadings for Use Items

Item No	Item label	Loadings	*M*	*SD*	α
USE2	How often do you use the following ICT facilities for research and academic-related activities? - Laptop or Desktop computers.	.69	6.396	.892	.793
USE4	How often do you use the following ICT facilities for research and academic? - Web browser (www).	.75	6.239	1.098	
USE5	How often do you use the following ICT facilities for research and academic? - Search engine (e.g. Google, Yahoo, etc.).	.83	6.383	.902	
USE6	How often do you use the following ICT facilities for research and academic? - Microsoft Office applications.	.73	6.308	933	
USE11	How often do you use the following ICT facilities for research and academic-related activities? - Document editing/composing.	.47	5.785	1.438	

The findings of the one-factor measurement model of use also revealed that the lecturers' views on the actual use of ICT facilities were indicated by five valid predictors. They explained approximately 49.5% of the variability of lecturers' use of ICT facilities for their teaching and research purposes in higher education as shown in Table 4.15.

Table 4.15: The Squared Multiple Correlations

Items Measured	
USE2	.479
USE4	.560
USE5	.692
USE6	.529
USE11	.219
The average total variance	0.495

4.7 ONE-FACTOR MEASUREMENT MODEL OF GRATIFICATION (GRAT)

The specific objective was to assess the lecturers' gratification in using ICT services for their teaching and research purposes in higher education. To address the objective 7, this study conducted a Confirmatory Factor Analysis (CFA) to confirm the lecturers' perceptions on their gratification in using ICT facilities and to examine the lecturers' overall gratification in the hypothesized TAG model; the Structural Equation Modeling (SEM) was applied. The original CFA model was performed on 10 items that explained the factor of gratification. The majority of the standardized factor loadings were greater than .78, with only two items that demonstrated loadings ranging from .61 to .65 (GRAT5 and GRAT10). However, the value of RMSEA and TLI were not as expected (see Appendix F). As such, the one-factor measurement model of gratification was revised due to violations and estimation. After deleting these items (GRAT1, GRAT2, GRAT5 and GRAT8), the analysis demonstrated an exceptional goodness-of-fit of the model. The items were removed one at a time according to their modification indices, with the largest being removed first, which showed the presence of multiple collinearity as shown in Table 4.16.

Table 4.16: The List of Removed Items

Item Deleted	Chi-square ($\chi 2$)	*df*	*p* value	RMSEA	CFI	TLI	SRMR
GRAT1	205.309	27	.000	.129	.938	.918	.063
GRAT2	125.762	20	.000	.116	.955	.937	.056
GRAT5	47.803	14	.000	.078	.984	.976	.038
GRAT8	13.301	9	.149	.035	.997	.995	.030

These are the 6 items that remained after the corrections: GRAT3, GRAT4, GRAT6, GRAT7, GRAT9 and GRAT10. These items were used as the indicators for the one-factor measurement model of gratification. Figure 4.6 depicts the error variances in the model represented by e3, e4, e6, e7, e9 and e10.

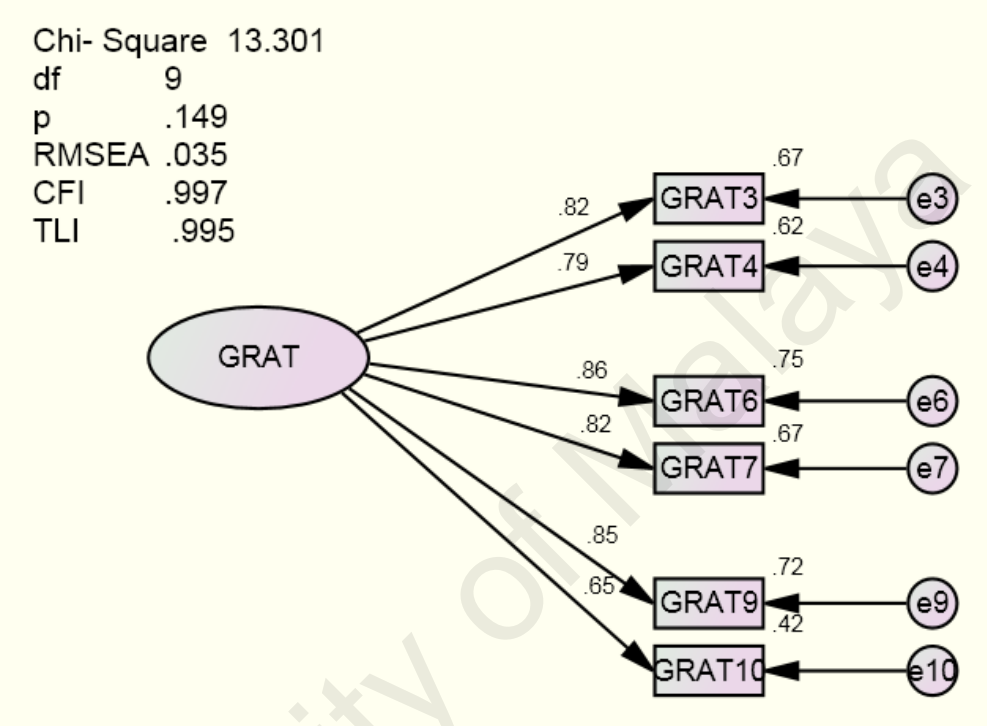

Figure 4.6: One-Factor Measurement Model for Gratification

The results of the model's overall goodness-of-fit statistics showed an exceptional fit; the model chi-square was statistically non-significant, $\chi 2$ (*df*=9) =13.301, *p*=.149 and the root mean square error of approximation (RMSEA) represented a goodness-of-fit of the model with a satisfactory value of .035; the value of the comparative fit index (CFI) was .997; the Tucker-Lewis index (TLI) value was .995 and the value of the standardized root mean square residual (SRMR) was .030. The CFA model fit indices were recommended by earlier studies (Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). The results in Figure 4.6 indicate that the parameters were free from offending estimates. The standardized factor demonstrated loadings ranging

from .65 to .86, representing statistically significant indicators. The item loadings are shown in Table 4.17.

Table 4.17: The Loadings for Gratification Items

Item No	Item label	Loadings	*M*	*SD*	α
GRAT3	I am satisfied with the ease of use of the ICT facilities.	.82	5.346	1.294	.908
GRAT4	The university ICT facilities have greatly affected the way I search for information and conduct my research.	.79	5.457	1.251	
GRAT6	Overall I am satisfied with the amount of time it takes to complete my task.	.86	5.237	1.361	
GRAT7	I am satisfied with the structure of accessible information (available as categories of research domain, or by date of issue—of journals in particular, or as full-texts or abstracts of theses and dissertations) of the university research databases.	.82	5.149	1.335	
GRAT9	I am satisfied in using ICT facilities for teaching, learning and research.	.85	5.467	1.239	
GRAT10	Overall I am satisfied with the Wireless Internet service provided at the university.	.65	4.997	1.596	

The findings of the one-factor measurement model of gratification showed that the lecturers' perceptions on the gratification of ICT facilities were represented by six valid predictors. They explained almost 64.1% of the variability of lecturers' gratification in using ICT facilities for their teaching and research purposes in higher education as shown in Table 4.18.

Table 4.18: The Squared Multiple Correlations

Items Measured	
GRAT3	.666
GRAT4	.623
GRAT6	.748
GRAT7	.667
GRAT9	.724
GRAT10	.422
The average total variance	0.641

SECTION 2: ESTIMATING THE FULL-FLEDGED STRUCTURAL EQUATION MODELING

4.8 THE HYPOTHESIZED TECHNOLOGY ADOPTION AND GRATIFICATION (TAG) MODEL

The structural equation modeling was adopted to evaluate the hypothesized Technology Adoption and Gratification (TAG) model. The estimation of parameters used the utmost likelihood technique provided by AMOS 18 to assess the model fit statistics, structural model, and measurement model (Byrne, 2000). The hypothesized TAG model was integrated by the six measurement models of the latent constructs, namely, computer self-efficacy (CSE), perceived usefulness (PU), perceived ease of use (PEU), intention to use (INT), use (USE) and gratification (GRAT) as tested individually by the Confirmatory Factor Analysis (CFA) for their overall goodness-of-fit of the models. The TAG model contained one exogenous variable (CSE), four mediator variables (PU, PEU, INT and USE), one endogenous variable (GRAT), thirty eight observed variables and forty three error variances as shown in Figure 4.7. Perceived usefulness and perceived ease of use were determined by computer self-efficacy. Furthermore, intention to use was determined directly by perceived ease of use and perceived usefulness and indirectly by computer self-efficacy. Besides this, the actual use was directly and indirectly influenced by intention to use, perceived

usefulness and perceived ease of use as well as computer self-efficacy. Similarly, gratification was directly and indirectly influenced by four mediator variables (PEU, PU, INT and USE), whereas computer self-efficacy was an indirect determinant of gratification.

In the hypothesized TAG model, the majority of the items exhibited a loading greater than .70. However, few items produced multiple large residuals with a low factor loading, and furthermore, they had large modification indices suggesting the presence of multiple collinearity (see Appendix G). Subsequently, the overall statistical analyses demonstrated inadequate fit statistics of the hypothesized TAG model to the empirical data: the chi-square, $\chi 2$ (df=654) =1781.099, p=.000; the value of the comparative fit index (CFI) was .893 and the Tucker-Lewis index (TLI) value was .885. The only exception was the root mean square error of approximation (RMSEA) value of .066, which was smaller than the recommended value. The results in Figure 4.7 exhibit that the parameter estimates of the hypothesized TAG model were free from offending values. Most path coefficients of the hypothesized TAG model's critical ratio (CR >1.96) were statistically significant. Significant paths were from: computer self-efficacy (CSE) to perceived usefulness (PU) and perceived ease of use (PEU), perceived usefulness to intention to use (INT) and gratification (GRAT) and perceived ease of use (PEU) to intention to use (INT) and gratification (GRAT). Similarly, the paths from intention to use (INT) to use (USE) and gratification (GRAT) were also significant. However, the paths from perceived usefulness (PU) and perceived ease of use (PEU) to use (USE) were not significant as well as the path from use (USE) to gratification (GRAT).

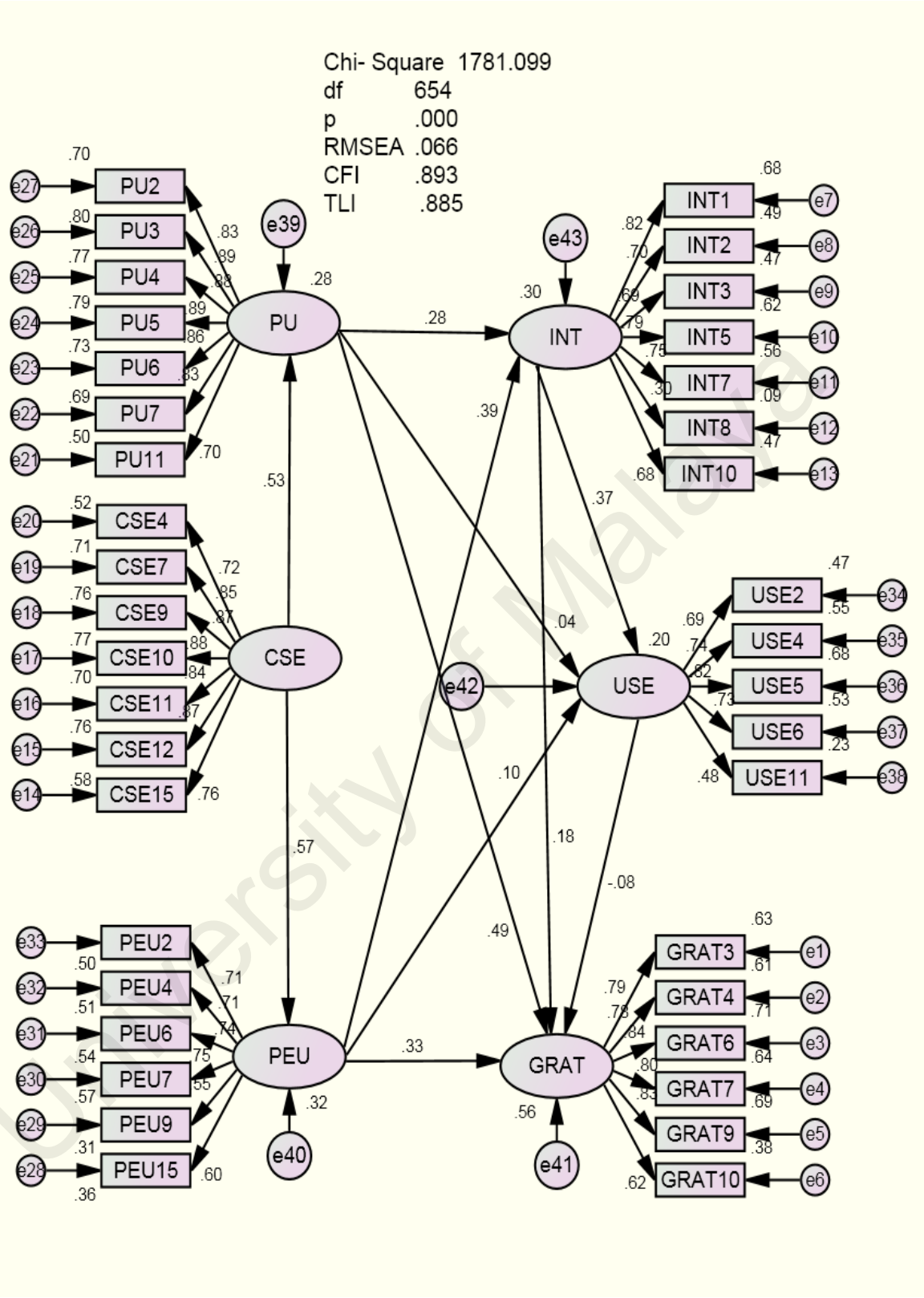

Figure 4.7: The Hypothesized Technology Adoption and Gratification (TAG) Model

The data demonstrated that computer self-efficacy was the most influential factor by a moderate amount in the TAG model in affecting the lecturers' perceived usefulness and perceived ease of use of ICT facilities in higher education. Likewise, perceived usefulness was slightly more influential than perceived ease of use in affecting lecturers' gratification in using ICT facilities. On the other hand, perceived ease of use was a more influential predictor than perceived usefulness in affecting lecturers' intention to use ICT facilities. The total standardized effect sizes of (i) computer self-efficacy → perceived ease of use and perceived usefulness were .566 and .528 respectively, (ii) perceived usefulness → intention to use, use and gratification were .278, .148 and .525 respectively, (iii) perceived ease of use → intention to use, use and gratification were .394, .250 and .378 respectively, (iv) intention to use → use and gratification were .373 and .147 respectively, (v) use → gratification was -.078, and (vi) computer self-efficacy → intention to use, use and gratification were .370, .220 and .491 respectively. In addition, the analysis revealed that the exogenous variable (CSE) explained almost 32% and 28% of the variance in perceived ease of use and perceived usefulness respectively, while the exogenous variable (CSE) and the two mediator variables (PU and PEU) collectively explained approximately 30% of the variability of lecturers' intention to use of ICT facilities in higher education. The exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) explained almost 20% of the variance of lecturers' actual use of ICT facilities. Finally, the exogenous variable (CSE) and the four mediator variables (PU, PEU, INT and USE) collectively explained approximately 56% of the variability of lecturers' gratification in using ICT facilities in higher education. The TAG model, however, had to be revised due to a few items that produced multiple large residuals and had large modification indices suggesting the presence of multi-collinearity.

Furthermore, the presence of a negative path coefficient that contradicted the hypothesis as well as the TAG model also exhibited inadequate convergent and discriminant validity. Thus, indicating that the parameters were not estimated or revealed in detail.

4.8.1 Hypotheses Testing

Testing the hypothesized TAG model, using the structural equation modeling, gave results that demonstrated the findings of the overall causal model, and specified the direct and indirect effect of exogenous variables, namely, *computer self-efficacy* on the mediated (*perceived ease of use*, *perceived usefulness, intention to use and use*) and endogenous (*gratification*) variables. The findings of the hypotheses test are as followed:

Hypothesis 1

Computer self-efficacy (CSE) will have a positive direct influence on lecturers' perceived ease of use (PEU) and perceived usefulness (PU) of ICT facilities in higher education.

The findings revealed that computer self-efficacy had a significant direct influence on perceived ease of use ($\beta = .57$, $p < .001$) and perceived usefulness ($\beta = .53$, $p < .001$) of ICT facilities in higher education.

Hypothesis 2

Perceived ease of use (PEU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.

The results demonstrated that perceived ease of use had a significant direct influence on lecturers' intention to use (β = .39, $p < .001$) and gratification (β = .33, $p < .001$) in using ICT facilities in higher education. However, it did not exert a statistically significant influence on use (β = .10, $p < .005$).

Hypothesis 3

Perceived usefulness (PU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.

The results of the hypothesized TAG model showed that perceived usefulness had a significant positive direct effect on intention to use (β = .28, $p < .001$) and gratification (β = .49, $p < .001$) in using ICT facilities in higher education. Nevertheless, perceived usefulness did not have a statistically significant influence on use (β = .04, $p > .005$).

Hypothesis 4

Intention to use (INT) will have a positive direct influence on lecturers' gratification (GRAT) and actual use (USE) of ICT facilities in higher education.

The findings of the TAG Model exhibited that intention to use had a positive direct influence on use (β = .37, $p < .001$) and gratification (β = .18, $p < .001$) in using ICT facilities.

Hypothesis 5

Actual use (USE) will have a positive direct influence on gratification (GRAT) in using ICT services in higher education.

The finding depicted that use had a direct effect on gratification, but in an adverse direction (β = -.08, $p > .005$).

Hypothesis 6

Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' intention to use (INT) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.

The results indicated that computer self-efficacy had a statistically significant and practically important indirect influence on intention to use mediated by perceived usefulness (Chi-square, $\chi 2 = 3.510$; $p = 0.000$). Subsequently, computer self-efficacy also had a statistically significant and practically important indirect influence on intention to use mediated by perceived ease of use (Chi-square, $\chi 2 = 3.599$; $p = 0.000$) as conducted by the Sobel test (Sobel, 1982).

Hypothesis 7

Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.

The findings showed that computer self-efficacy had a statistically significant and practically important indirect influence on lecturers' gratification in using ICT facilities mediated by perceived ease of use (Chi-square, $\chi 2 = 2.978$; $p = 0.001$). Similarly, computer self-efficacy also had a statistically significant and practically important indirect influence on gratification mediated by perceived usefulness (Chi-square, $\chi 2 = 5.098$; $p = 0.000$) as conducted by the Sobel test (Sobel, 1982).

Hypothesis 8

Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' use (USE) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.

The results discovered that computer self-efficacy did not have a significant indirect influence on lecturers' use of ICT facilities mediated by perceived ease of use ($\chi 2 = 1.254$; $p = 0.104$) and perceived usefulness ($\chi 2 = 0.724$; $p = 0.234$), respectively as conducted by the Sobel test (Sobel, 1982).

Hypothesis 9

Perceived ease of use (PEU) and Perceived usefulness (PU) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by intention to use (INT), respectively.

The findings confirmed that perceived ease of use had a statistically significant indirect influence on gratification in using ICT facilities mediated by intention to use (Chi-square, $\chi 2 = 2.257$; $p = 0.011$), while perceived usefulness showed a significant indirect influence on lecturers' gratification mediated by intention to use of ICT facilities (Chi-square, $\chi 2 = 2.255$; $p = 0.012$) as conducted by the Sobel test (Sobel, 1982).

Hypothesis 10

Intention to use (INT) will have a positive indirect influence on lecturers' gratification (GRAT) mediated by actual use (USE) of ICT facilities in higher education.

The results showed that intention to use did not have a significant indirect influence on lecturers' gratification mediated by actual use of ICT facilities due to the

negative path coefficient (Chi-square, $\chi 2$ = -1.015; p = 0.154) as conducted by the Sobel test (Sobel, 1982).

Hypothesis 11

There will be a cross-cultural invariant of the causal structure of the TAG model.

The findings of the invariance analysis of the TAG model demonstrated that the revised TAG model is valid for measuring lecturers' adoption and gratification in using ICT facilities in higher education for their teaching and research purposes. However, the invariance analysis revealed that the TAG model works differently in cross-cultures. This means that there was a cross-cultural invariant in lecturers' adoption and gratification in using ICT facilities.

The results of the Hypotheses testing are summarized in Table 4.19.

Table 4.19: The Summary of the Hypotheses Testing

Hypotheses	Description	Results
H1	Computer self-efficacy (CSE) will have a positive direct influence on lecturers' perceived ease of use (PEU) and perceived usefulness (PU) of ICT facilities in higher education.	Supported
H2	Perceived ease of use (PEU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.	Supported
H3	Perceived usefulness (PU) will have a positive direct influence on lecturers' intention to use (INT), actual use (USE) and gratification (GRAT) in using ICT facilities in higher education.	Supported
H4	Intention to use (INT) will have a positive direct influence on lecturers' gratification (GRAT) and actual use (USE) of ICT facilities in higher education.	Supported
H5	Actual use (USE) will have a positive direct influence on gratification (GRAT) in using ICT services in higher education.	Not Supported
H6	Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' intention to use (INT) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.	Supported
H7	Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively	Supported
H8	Computer self-efficacy (CSE) will have a positive indirect influence on lecturers' use (USE) of ICT facilities mediated by perceived ease of use (PEU) and perceived usefulness (PU), respectively.	Not Supported
H9	Perceived ease of use (PEU), Perceived usefulness (PU) will have a positive indirect influence on lecturers' gratification (GRAT) in using ICT facilities mediated by intention to use (INT), respectively.	Supported
H10	Intention to use (INT) will have a positive indirect influence on lecturers' gratification (GRAT) mediated by actual use (USE) of ICT facilities in higher education.	Not Supported
H11	There will be a cross-cultural invariant of the causal structure of the TAG model.	Supported

4.9 THE REVISED TECHNOLOGY ADOPTION AND GRATIFICATION (TAG) MODEL

The hypothesized TAG model was revised and re-estimated in order to examine its overall adequacy. In the re-specified TAG model, the items were removed one at a time (CSE15, PEU9, PEU15, GRAT7, GRAT10, USE2, USE11, INT8 and INT10) which produced multiple large residuals and associated with the largest modification indices with relatively low factor loadings, and that were found to be cross-loaded as shown in Table 4.20.

Table 4.20: The List of Removed Items

Item Deleted	Chi-square (χ2)	*df*	*p* value	RMSEA	CFI	TLI
CSE15	1701.441	621	.000	.066	.894	.886
PEU9	1571.680	586	.000	.065	.901	.894
PEU15	1431.166	552	.000	.063	.909	.902
GRAT7	1361.367	519	.000	.064	.909	.902
GRAT10	1279.240	487	.000	.064	.913	.905
USE2	1226.239	456	.000	.065	.913	.905
USE11	1165.950	426	.000	.066	.915	.907
INT8	1154.941	397	.000	.070	.913	.905
INT10	1095.131	369	.000	.071	.914	.906

After removing these items, the revised TAG model exhibited adequate convergent and discriminant validity (see Appendix H), with all loadings showing a value greater than 0.70 as shown in Table 4.21. Thus, only 29 items now remained from the initial TAG model set of 38 items. Figure 4.8 presents the parameter estimates of the revised TAG, which were free from offending values. The magnitude of the factor loadings and path coefficients were statistically significant.

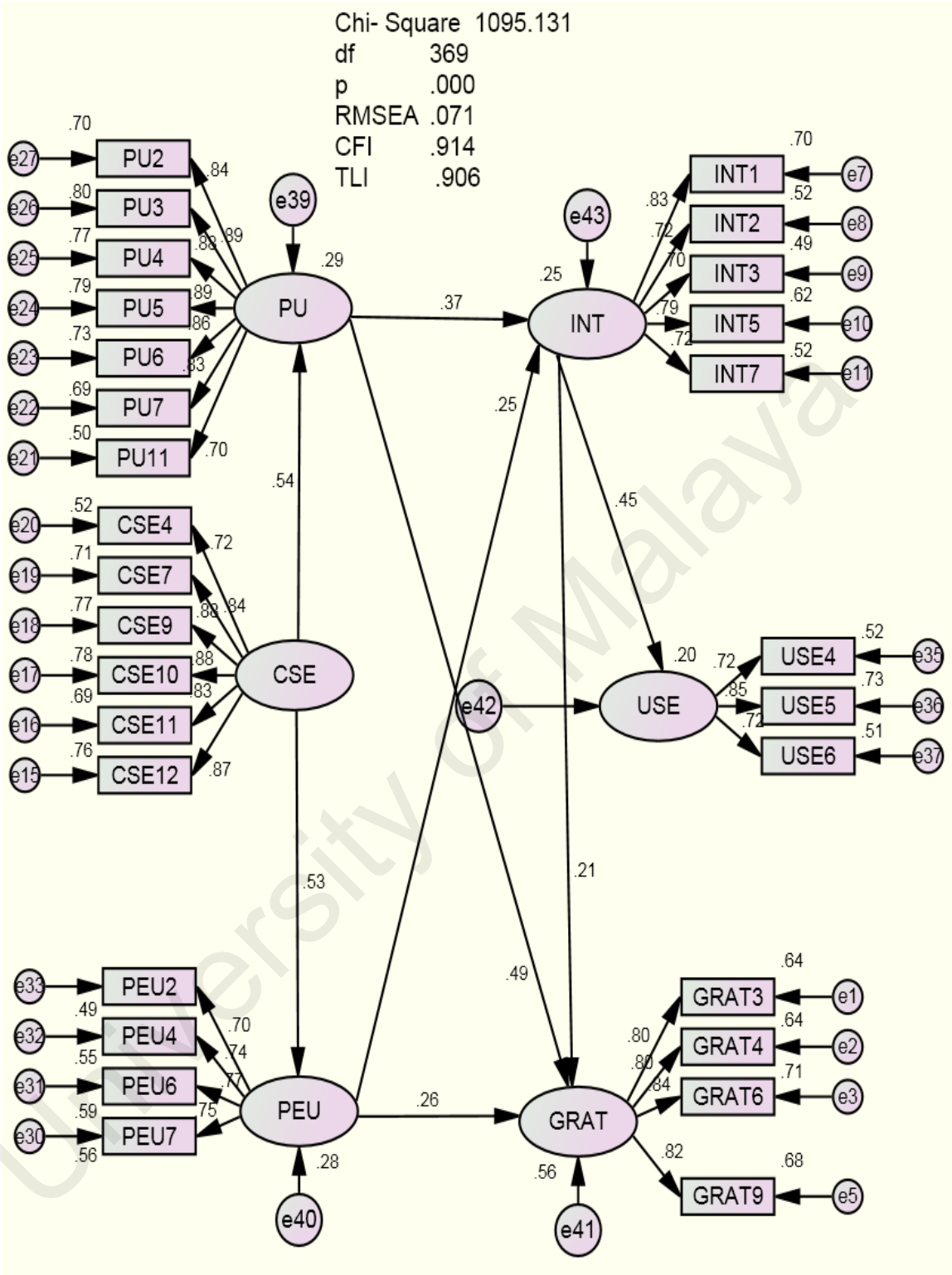

Figure 4.8: The Revised Technology Adoption and Gratification (TAG) Model

With the revised TAG model, the direct paths from perceived usefulness (PU) and perceived ease of use (PEU) to use (USE) were dropped due to low coefficients of 0.04 (PU > USE) and 0.10 (PEU > USE), respectively. The direct path from use (USE) to gratification (GRAT) was also dropped due to a negative path coefficient of -0.08 (USE > GRAT) which indicated that the respective hypotheses were not supported. The revised model depicted a goodness-of-fit to the empirical data as indicated by the following fit indices: $\chi 2$ (df = 369) = 1095.131; p < 0.000; RMSEA = 0.071; CFI = 0.914; TLI = 0.906 as supported by Byrne (2000). The Figure 4.8 shows the error variances in the revised TAG model represented by e1, e2, e3, e5, e7, e8, e9, e10, e11, e15, e16, e17, e18, e19, e20, e21, e22, e23, e24, e25, e26, e27, e30, e31, e32, e33, e35, e36, e37, e39, e40, e41, e42 and e43.

In addition, the data of the revised TAG model revealed standardized path coefficients as shown in Figure 4.8. As anticipated, hypotheses *H1* and *H2* were supported, the findings revealed that computer self-efficacy had a significant positive direct influence on perceived usefulness (β = 0.54, p<0.001) and perceived ease of use (β = 0.53, p < .001). On the other hand, perceived ease of use had a significant direct influence on gratification (β = 0.26, p<0.001) and intention to use (β = 0.25, p<0.001). Subsequently, hypotheses *H3* and *H4* were supported, the results of the revised TAG model discovered that perceived usefulness had a significant direct influence on intention to use (β = 0.37, p<0.001) and gratification (β = 0.49, p<0.001). Besides this, intention to use had also a significant direct influence on use (β = 0.45, p<0.001) and gratification (β = 0.21, p<0.001). Moreover, *H6* was also supported by the findings of the revised TAG model which indicated that computer self-efficacy had a statistically significant and practically important indirect influence on intention to use mediated by perceived usefulness (Chi-square, $\chi 2$ = 4.451; p = 0.000). Subsequently, computer

self-efficacy also had a statistically significant and practically important indirect influence on intention to use mediated by perceived ease of use (Chi-square, $\chi 2$ = 3.224; p = 0.000) as conducted by the Sobel test (Sobel, 1982). Furthermore, The results of the revised TAG model demonstrated that computer self-efficacy had a statistically significant and practically important indirect influence on lecturers' gratification in using ICT facilities mediated by perceived ease of use (Chi-square, $\chi 2$ = 3.411; p = 0.000). Similarly, computer self-efficacy also had a statistically significant and practically important indirect influence on gratification mediated by perceived usefulness (Chi-square, $\chi 2$ = 5.253; p = 0.000) as conducted by the Sobel test and validated *H7* (Sobel, 1982). Eventually, *H9* was supported as the results of the revised TAG model discovered that perceived ease of use had a statistically significant indirect influence on gratification in using ICT facilities mediated by intention to use (Chi-square, $\chi 2$ = 2.503; p = 0.006), while perceived usefulness showed a significant indirect influence on lecturers' gratification mediated by intention to use of ICT facilities (Chi-square, $\chi 2$ = 2.912; p = 0.001) as conducted by the Sobel test (Sobel, 1982). Furthermore, all path coefficients of the causal structure were practically important and statistically significant, and the strongest value of the standardized path coefficient of computer self-efficacy on perceived usefulness was 0.54. The data also demonstrated that computer self-efficacy was a moderately more influential factor in the revised TAG model in directly affecting the lecturers' perceived usefulness and perceived ease of use as well as indirectly influencing the lecturers' intention to use, use and gratification in using ICT facilities in higher education for their research and teaching purposes. Moreover, the total standardized effect sizes of (i) computer self-efficacy → perceived ease of use and perceived usefulness were .525 and .536 respectively, (ii) perceived usefulness → intention to use, use and gratification

were .375, .168 and .574 respectively, (iii) perceived ease of use → intention to use, use and gratification were .247, .111 and .310 respectively, (iv) intention to use → use and gratification were .447 and .231 respectively, and (v) computer self-efficacy → intention to use, use and gratification were .331, .148 and .471 respectively. In addition, the analysis revealed that the exogenous variable (CSE) explained almost 28% and 29% of the variance in perceived ease of use and perceived usefulness respectively, while the exogenous variable (CSE) and the two mediator variables (PU and PEU) collectively explained approximately 25% of the variability of lecturers' intention to use of ICT facilities in higher education. Similarly, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) explained almost 20% of the variance of lecturers' actual use of ICT facilities. Finally, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) collectively explained approximately 56% of the variability of lecturers' gratification in using ICT facilities in higher education.

Table 4.21: Valid Items of the Revised TAG Model and Their Corresponding Loadings, Means, Standard Deviations and Alpha Values

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Computer Self-efficacy (CSE)	CSE4	I have the skills required to communicate electronically with my colleagues and students.	.72	5.974	.988	.933
	CSE7	I have the skills required to use ICT facilities to enhance the effectiveness of my teaching, learning and research.	.84	5.931	.984	
	CSE9	I have the ability to navigate my way through the ICT facilities.	.88	5.714	1.051	
	CSE10	I have the skills required to use the ICT facilities to enhance the quality of my research works.	.88	5.785	1.009	
	CSE11	I have the ability to save and print journals/articles from the research databases.	.83	5.989	1.016	

Table 4.21, continued

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
	CSE12	I have the knowledge and skills required to benefit from using the university ICT facilities.	.87	5.891	.955	
Perceived Usefulness (PU)	PU2	Using the ICT services available at the university increases my research productivity.	.84	5.555	1.270	.944
	PU3	The current university ICT system makes work more interesting.	.89	5.217	1.324	
	PU4	ICT facilities at the university improve the quality of the work I do.	.88	5.401	1.289	
	PU5	Using the university ICT facilities enhances my research skills.	.89	5.335	1.285	
	PU6	Using the university ICT facilities would make it easier for me to find information.	.86	5.558	1.304	
	PU7	ICT services at the university make information always available to users.	.83	5.247	1.379	
	PU11	Using the university ICT facilities provides me with the latest information on specific areas of research.	.70	5.628	1.226	
Perceived Ease of Use (PEU)	PEU2	I find it easy to access the university research databases.	.70	5.300	1.313	.830
	PEU4	Interacting with the research databases system requires minimal effort on my part.	.74	4.931	1.366	
	PEU6	Interacting with the university research databases system is very stimulating for me.	.77	4.846	1.388	
	PEU7	I find it easy to select articles/journals of different categories using research databases (Education/Engineering/Business, etc.).	.75	5.346	1.246	

Table 4.21, continued

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Intention to Use (INT)	INT1	I will use the ICT facilities to carry out my research activities.	.83	6.070	1.038	.874
	INT2	I will use computer applications to present lecture materials in class.	.72	6.280	1.001	
	INT3	I will use Microsoft office applications to write my research papers.	.70	6.189	1.157	
	INT5	I intend to use ICT facilities for teaching, learning and research purposes frequently.	.79	5.916	1.104	
	INT7	I will use the university research databases to update myself on the research areas I am pursuing.	.72	5.861	1.092	
Actual Use (USE)	USE4	How often do you use the following ICT facilities for research and academic? – Web browser (www).	.72	6.239	1.098	.802
	USE5	How often do you use the following ICT facilities for research and academic? – Search engine (e.g. Google, Yahoo, etc.).	.85	6.383	.902	
	USE6	How often do you use the following ICT facilities for research and academic? – Microsoft Office applications.	.72	6.308	.933	
Gratification (GRAT)	GRAT3	I am satisfied with the ease of use of the ICT facilities.	.80	5.346	1.294	.899
	GRAT4	The university ICT facilities have greatly affected the way I search for information and conduct my research.	.80	5.457	1.251	
	GRAT6	Overall I am satisfied with the amount of time it takes to complete my task.	.84	5.237	1.361	
	GRAT9	I am satisfied in using ICT facilities for teaching, learning and research.	.82	5.467	1.239	

4.10 CROSS-CULTURAL VALIDATION OF TAG MODEL

One of the objectives of this study was to evaluate the structural invariance of the TAG model regarding the moderating effect of the cross-cultural dimension of the respondents. In order to test cross-cultural-invariant, a two-stage analysis i.e., configural and metric invariance, was conducted on both the respondents of the University of Malaya (n1 = 200) and Jiaxing University (n2 = 196). The revised TAG model was estimated using a total of 396 lecturers who were collected from two comprehensive public universities, namely, the University of Malaya in Malaysia and Jiaxing University in China. However, to perform invariance analyses between the groups of Malaysian and Chinese participants, the present study separated the original pool of data into two groups. The overall fit indices of the revised TAG model for Malaysian respondents discovered a satisfactory fit to the empirical data as demonstrated by the following fit indices: $\chi 2$ (df = 369) = 897.527; p < 0.000; RMSEA = 0.085; CFI = 0.882; TLI = 0.870 as shown in Figure 4.9. Moreover, the data of the revised TAG model for Malaysian respondents confirmed the standardized path coefficients as indicated in Figure 4.30. As anticipated, hypotheses *H1* and *H2* were accepted, the results exhibited that Malaysian lecturers' computer self-efficacy had a significant positive direct effect on their perceived usefulness (β = 0.63, p<0.001) and perceived ease of use (β = 0.57, p < .001). On the other hand, Malaysian lecturers' perceived ease of use had a significant direct influence on their gratification (β = 0.26, p<0.001) but it did not exert any significant direct effect on intention to use (β = 0.06, p≥0.05). Additionally, hypotheses *H3* and *H4* were supported, the findings of revised TAG model for Malaysian participants revealed that lecturers' perceived usefulness had a significant direct influence on their intention to use (β = 0.56, p<0.001) and gratification (β = 0.40, p<0.001), while Malaysian lecturers' intention to use had a

significant direct effect on their actual use (β = 0.32, p<0.001) and gratification (β = 0.30, p<0.001) in using ICT facilities for their teaching and research purposes in higher education.

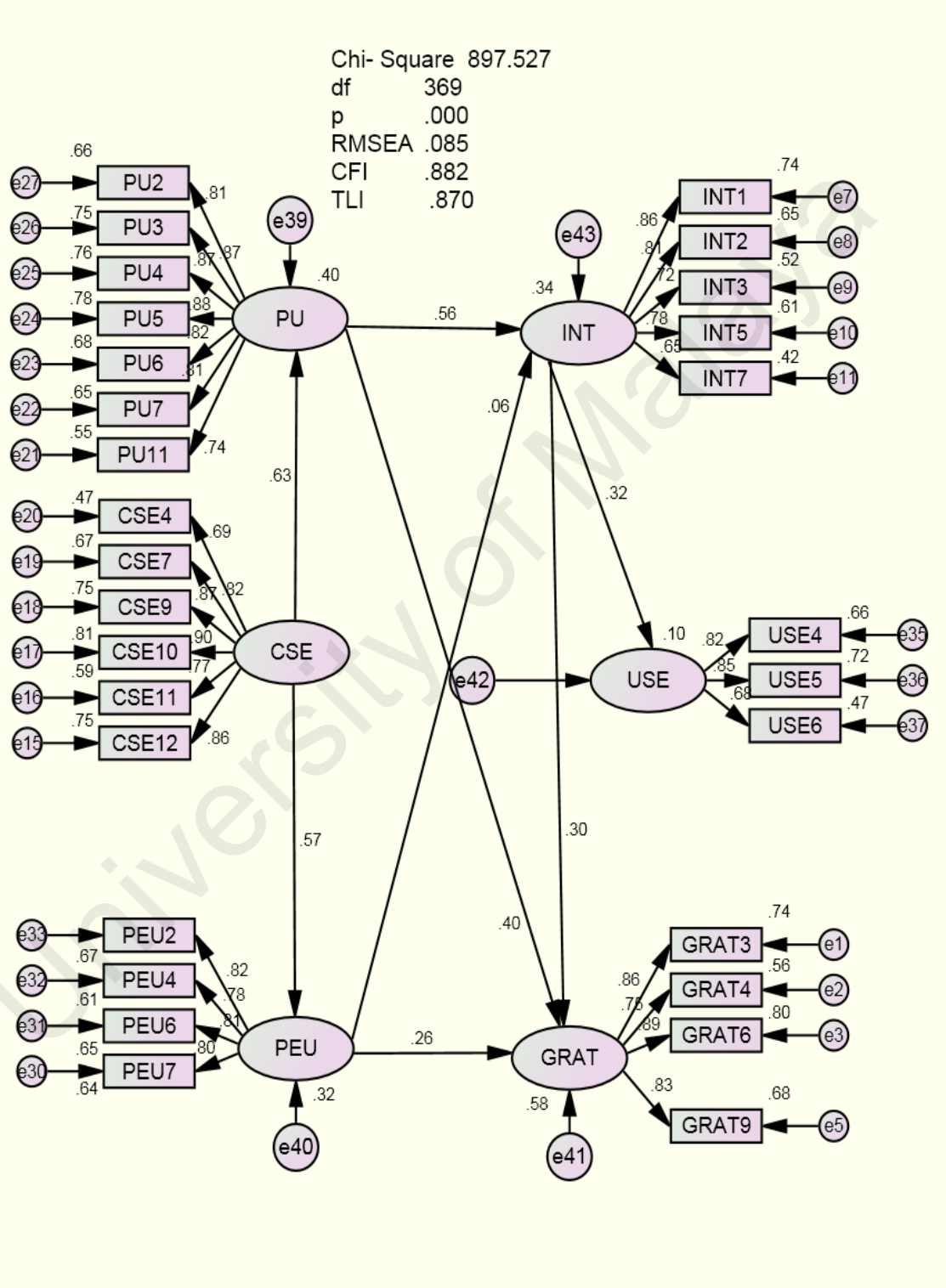

Figure 4.9: The Revised TAG Model for Malaysian Participants

Furthermore, *H6* was also supported, the results of the revised TAG model for Malaysian respondents demonstrated that Malaysiann lecturers' computer self-efficacy had a statistically significant and practically important indirect effect on their intention to use mediated by perceived usefulness (Chi-square, $\chi 2 = 4.952$; $p = 0.000$). However, Malaysian lecturers' computer self-efficacy did not show a statistically significant and practically important indirect effect on their intention to use mediated by perceived ease of use due to the low path coefficient. In addition, The findings of the revised TAG model for Malaysian participants showed that lecturers' computer self-efficacy had a statistically significant and practically important indirect influence on their gratification in using ICT facilities mediated by perceived ease of use (Chi-square, $\chi 2 = 2.956$; $p = 0.001$). Meanwhile, Malaysian lecturers' computer self-efficacy also had a statistically significant and practically important indirect effect on their gratification mediated by perceived usefulness (Chi-square, $\chi 2 = 3.273$; $p = 0.000$) as conducted by the Sobel test and validated *H7* (Sobel, 1982). Lastly, *H9* was supported as the findings of the revised TAG model for Malaysian participants indicated that perceived usefulness had a statistically significant indirect effect on gratification in using ICT facilities for their teaching and research purposes in higher education mediated by intention to use (Chi-square, $\chi 2 = 2.702$; $p = 0.003$) as conducted by the Sobel test (Sobel, 1982), while lecturers' perceived ease of use did not exert any significant indirect influence on their gratification mediated by intention to use of ICT facilities due to the insignificant path coefficient. Moreover, all path coefficients of the causal structure were practically important and statistically significant, while the strongest value of the standardized path coefficient of Malaysian lecturers' computer self-efficacy on their perceived usefulness was 0.63. The data also confirmed that Malaysian lecturers' computer self-efficacy was the most influential

factor in the revised TAG model for Malaysian participants in directly influencing the lecturers' perceived usefulness and perceived ease of use as well as indirectly affecting the lecturers' intention to use, use and gratification in using ICT facilities for their teaching and research purposes in higher education.

Subsequently, the total standardized effect sizes of (i) computer self-efficacy → perceived ease of use and perceived usefulness were .570 and .629 respectively, (ii) perceived usefulness → intention to use, use and gratification were .563, .179 and .573 respectively, (iii) perceived ease of use → intention to use, use and gratification were .056, .018 and .277 respectively, (iv) intention to use → use and gratification were .318 and .301 respectively, and (v) computer self-efficacy → intention to use, use and gratification were .386, .123 and .518 respectively. Consequently, the analysis of the revised TAG model for Malaysian participants discovered that the exogenous variable (CSE) explained almost 32% and 40% of the variance in perceived ease of use and perceived usefulness respectively, while the exogenous variable (CSE) and the two mediator variables (PU and PEU) collectively explained almost 34% of the variability of Malaysian lecturers' intention to use of ICT facilities for their teaching and research purposes in higher education. Similarly, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) explained almost 10% of the variance of lecturers' actual use of ICT facilities. Finally, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) collectively explained approximately 58% of the variability of lecturers' gratification in using ICT facilities in higher education. The revised TAG model for Malaysian participants depicted adequate convergent and discriminant validity (see Appendix I), with the majority of the items' loadings showing a value greater than 0.70 as shown in Table 4.22.

Table 4.22: Valid Items of the Revised TAG Model for Malaysian Participants and Their Corresponding Loadings, Means, Standard Deviations and Alpha Values

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Computer Self-efficacy (CSE)	CSE4	I have the skills required to communicate electronically with my colleagues and students.	.69	5.974	.988	.933
	CSE7	I have the skills required to use ICT facilities to enhance the effectiveness of my teaching, learning and research.	.82	5.931	.984	
	CSE9	I have the ability to navigate my way through the ICT facilities.	.87	5.714	1.051	
	CSE10	I have the skills required to use the ICT facilities to enhance the quality of my research works.	.90	5.785	1.009	
	CSE11	I have the ability to save and print journals/articles from the research databases.	.77	5.989	1.016	
	CSE12	I have the knowledge and skills required to benefit from using the university ICT facilities.	.86	5.891	.955	
Perceived Usefulness (PU)	PU2	Using the ICT services available at the university increases my research productivity.	.81	5.555	1.270	.944
	PU3	The current university ICT system makes work more interesting.	.87	5.217	1.324	
	PU4	ICT facilities at the university improve the quality of the work I do.	.87	5.401	1.289	
	PU5	Using the university ICT facilities enhances my research skills.	.88	5.335	1.285	
	PU6	Using the university ICT facilities would make it easier for me to find information.	.82	5.558	1.304	
	PU7	ICT services at the university make information always available to users.	.81	5.247	1.379	
	PU11	Using the university ICT facilities provides me with the latest information on specific areas of research.	.74	5.628	1.226	

Table 4.22, continued

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Perceived Ease of Use (PEU)	PEU2	I find it easy to access the university research databases.	.82	5.300	1.313	.830
	PEU4	Interacting with the research databases system requires minimal effort on my part.	.78	4.931	1.366	
	PEU6	Interacting with the university research databases system is very stimulating for me.	.81	4.846	1.388	
	PEU7	I find it easy to select articles/journals of different categories using research databases (Education/Engineering/Business, etc.).	.80	5.346	1.246	
Intention to Use (INT)	INT1	I will use the ICT facilities to carry out my research activities.	.86	6.070	1.038	.874
	INT2	I will use computer applications to present lecture materials in class.	.81	6.280	1.001	
	INT3	I will use Microsoft office applications to write my research papers.	.72	6.189	1.157	
	INT5	I intend to use ICT facilities for teaching, learning and research purposes frequently.	.78	5.916	1.104	
	INT7	I will use the university research databases to update myself on the research areas I am pursuing.	.65	5.861	1.092	
Actual Use (USE)	USE4	How often do you use the following ICT facilities for research and academic? – Web browser (www).	.82	6.239	1.098	.802
	USE5	How often do you use the following ICT facilities for research and academic? – Search engine (e.g. Google, Yahoo, etc.).	.85	6.383	.902	
	USE6	How often do you use the following ICT facilities for research and academic? – Microsoft Office applications.	.68	6.308	.933	

Table 4.22, continued

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Gratification (GRAT)	GRAT3	I am satisfied with the ease of use of the ICT facilities.	.86	5.346	1.294	.899
	GRAT4	The university ICT facilities have greatly affected the way I search for information and conduct my research.	.75	5.457	1.251	
	GRAT6	Overall I am satisfied with the amount of time it takes to complete my task.	.89	5.237	1.361	
	GRAT9	I am satisfied in using ICT facilities for teaching, learning and research.	.83	5.467	1.239	

On the other hand, the overall fit statistics of the revised TAG model for Chinese participants showed an adequate fit to the empirical data as indicated by the following fit indices: $\chi 2$ (df = 369) = 840.593; $p < 0.000$; RMSEA = 0.081; CFI = 0.882; TLI = 0.870 as depicted Figure 4.10. In addition, the data of the revised TAG model for Chinese participants revealed the standardized path coefficients as shown in Figure 4.10. As anticipated, hypotheses *H1* and *H2* were supported, the findings discovered that Chinese lecturers' computer self-efficacy had a significant positive direct influence on their perceived usefulness ($\beta = 0.39$, $p<0.001$) and perceived ease of use ($\beta = 0.44$, $p < .001$). On the other hand, Chinese lecturers' perceived ease of use had a significant direct influence on their gratification ($\beta = 0.29$, $p<0.001$) and intention to use ($\beta = 0.46$, $p<0.001$). In addition, hypotheses *H3* and *H4* were accepted, the results of the revised TAG model for Chinese respondents exhibited that lecturers' perceived usefulness had a significant direct influence on their gratification ($\beta = 0.50$, $p<0.001$) but it did not exert any significant influence on intention to use ($\beta = 0.05$, $p\geq0.05$), while Chinese lecturers' intention to use had a significant direct effect on their actual use ($\beta = 0.42$, $p<0.001$) and gratification ($\beta = 0.15$, $p<0.05$) in using ICT facilities for their teaching and research purposes in higher education.

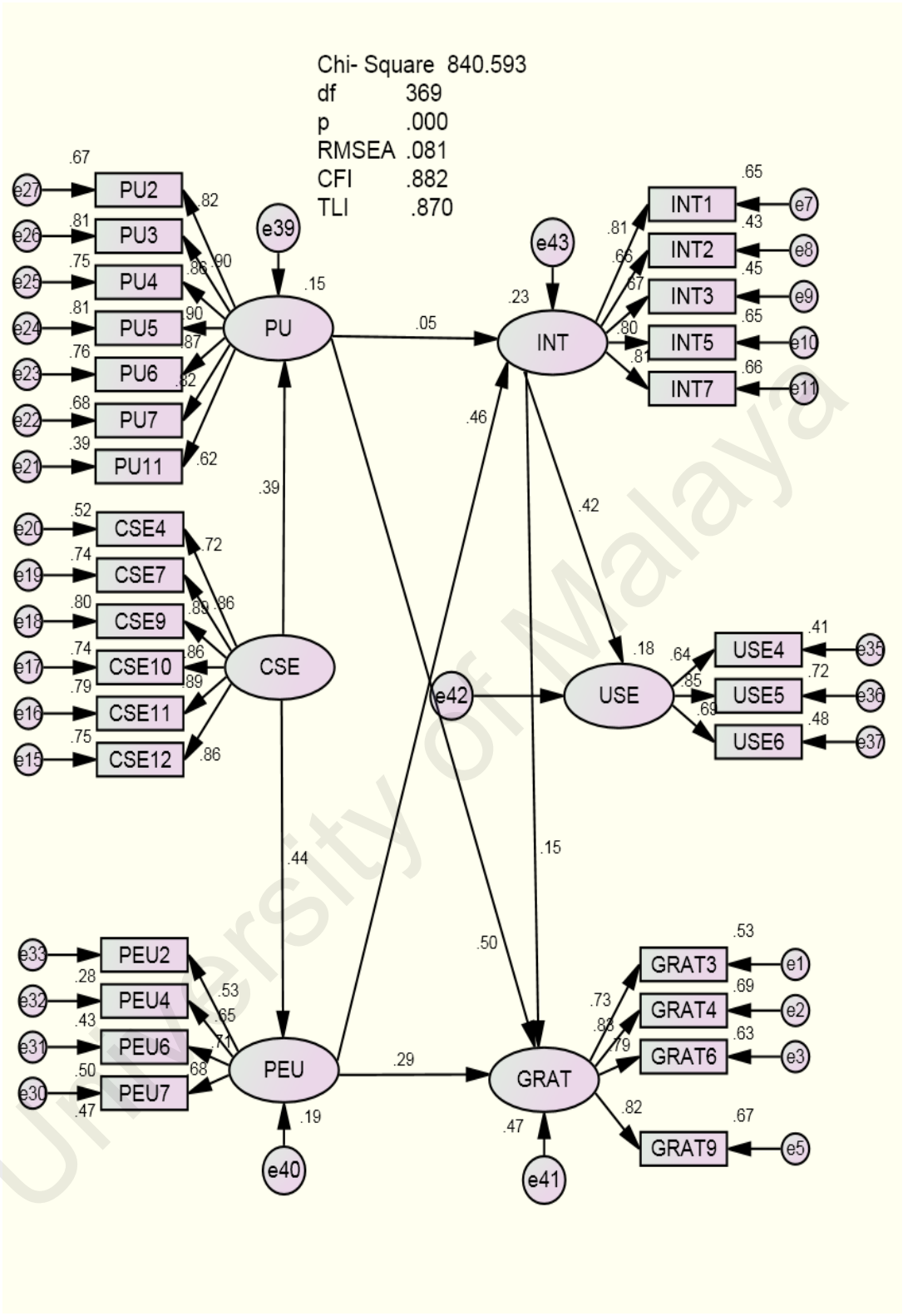

Figure 4.10: The Revised TAG Model for Chinese Participants

Moreover, hypothesis *H6* was also supported as the results of the revised TAG model for Chinese participants indicated that Chinese lecturers' computer self-

efficacy had a statistically significant and practically important indirect effect on their intention to use mediated by perceived ease of use (Chi-square, $\chi 2 = 3.767$; $p = 0.000$). However, Chinese lecturers' computer self-efficacy did not confirm a statistically significant and practically important indirect effect on their intention to use mediated by perceived usefulness due to the insignificant path coefficient. Subsequently, The results of the revised TAG model for Chinese respondents demonstrated that lecturers' computer self-efficacy had a statistically significant and practically important indirect effect on their gratification in using ICT facilities mediated by perceived ease of use (Chi-square, $\chi 2 = 2.920$; $p = 0.001$). Similarly, Chinese lecturers' computer self-efficacy also had a statistically significant and practically important indirect influence on their gratification mediated by perceived usefulness (Chi-square, $\chi 2 = 3.349$; $p = 0.000$) as conducted by the Sobel test and validated *H7* (Sobel, 1982). Finally, hypothesis *H9* was supported as the results of the revised TAG model for Chinese lecturers' revealed that perceived ease of use had a statistically significant indirect effect on gratification in using ICT facilities for their teaching and research purposes in higher education mediated by intention to use (Chi-square, $\chi 2 = 1.464$; $p = 0.071$) as conducted by the Sobel test (Sobel, 1982), while lecturers' perceived usefulness did not exert any significant indirect effect on their gratification mediated by intention to use of ICT facilities due to the low path coefficient. Additionally, all the path coefficients of the causal structure were practically important and statistically significant, while the strongest value of the standardized path coefficient of Chinese lecturers' perceived usefulness on their gratification was 0.50. The data also explored that Chinese lecturers' perceived usefulness of ICT facilities was the most dominant determinant in the revised TAG model for Chinese participants in directly affecting the lecturers' perceived usefulness of ICT facilities for their teaching and research

purposes in higher education.

Furthermore, the total standardized effect sizes of (i) computer self-efficacy → perceived ease of use and perceived usefulness were .432 and .370 respectively, (ii) perceived usefulness → intention to use, use and gratification were .061, .024 and .597 respectively, (iii) perceived ease of use → intention to use, use and gratification were .500, .201 and .407 respectively, (iv) intention to use → use and gratification were .402 and .161 respectively, and (v) computer self-efficacy → intention to use, use and gratification were .238, .096 and .397 respectively. Subsequently, the analysis of the revised TAG model for Chinese participants exhibited that the exogenous variable (CSE) explained almost 19% and 15% of the variance in perceived ease of use and perceived usefulness respectively, while the exogenous variable (CSE) and the two mediator variables (PU and PEU) collectively explained approximately 23% of the variability of Chinese lecturers' intention to use of ICT facilities for their teaching and research purposes in higher education. Meanwhile, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) explained almost 18% of the variance of lecturers' actual use of ICT facilities. Finally, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) collectively explained around 47% of the variability of lecturers' gratification in using ICT facilities for their teaching and research purposes in higher education. The revised TAG model for Chinese participants confirmed adequate convergent and discriminant validity (see Appendix I), with most of the indicators' loadings showing a value greater than 0.70 as demonstrated in Table 4.23.

Table 4.23: Valid Items of the Revised TAG Model for Chinese Participants and Their Corresponding Loadings, Means, Standard Deviations and Alpha Values

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	CSE7	I have the skills required to use ICT facilities to enhance the effectiveness of my teaching, learning and research.	.82	5.931	.984	
	CSE9	I have the ability to navigate my way through the ICT facilities.	.87	5.714	1.051	
	CSE10	I have the skills required to use the ICT facilities to enhance the quality of my research works.	.90	5.785	1.009	
	CSE11	I have the ability to save and print journals/articles from the research databases.	.77	5.989	1.016	
	CSE12	I have the knowledge and skills required to benefit from using the university ICT facilities.	.86	5.891	.955	
Perceived Usefulness (PU)	PU2	Using the ICT services available at the university increases my research productivity.	.81	5.555	1.270	.944
	PU3	The current university ICT system makes work more interesting.	.87	5.217	1.324	
	PU4	ICT facilities at the university improve the quality of the work I do.	.87	5.401	1.289	
	PU5	Using the university ICT facilities enhances my research skills.	.88	5.335	1.285	
	PU6	Using the university ICT facilities would make it easier for me to find information.	.82	5.558	1.304	
	PU7	ICT services at the university make information always available to users.	.81	5.247	1.379	
	PU11	Using the university ICT facilities provides me with the latest information on specific areas of research.	.74	5.628	1.226	

Table 4.23, continued

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Perceived Ease of Use (PEU)	PEU2	I find it easy to access the university research databases.	.82	5.300	1.313	.830
	PEU4	Interacting with the research databases system requires minimal effort on my part.	.78	4.931	1.366	
	PEU6	Interacting with the university research databases system is very stimulating for me.	.81	4.846	1.388	
	PEU7	I find it easy to select articles/journals of different categories using research databases (Education/Engineering/Business, etc.).	.80	5.346	1.246	
Intention to Use (INT)	INT1	I will use the ICT facilities to carry out my research activities.	.86	6.070	1.038	.874
	INT2	I will use computer applications to present lecture materials in class.	.81	6.280	1.001	
	INT3	I will use Microsoft office applications to write my research papers.	.72	6.189	1.157	
	INT5	I intend to use ICT facilities for teaching, learning and research purposes frequently.	.78	5.916	1.104	
	INT7	I will use the university research databases to update myself on the research areas I am pursuing.	.65	5.861	1.092	
Actual Use (USE)	USE4	How often do you use the following ICT facilities for research and academic? – Web browser (www).	.82	6.239	1.098	.802
	USE5	How often do you use the following ICT facilities for research and academic? – Search engine (e.g. Google, Yahoo, etc.).	.85	6.383	.902	
	USE6	How often do you use the following ICT facilities for research and academic? – Microsoft Office applications.	.68	6.308	.933	

Table 4.23, continued

Constructs	Items	Item Measure	Loadings	*M*	*SD*	Alpha
Gratification (GRAT)	GRAT3	I am satisfied with the ease of use of the ICT facilities.	.86	5.346	1.294	.899
	GRAT4	The university ICT facilities have greatly affected the way I search for information and conduct my research.	.75	5.457	1.251	
	GRAT6	Overall I am satisfied with the amount of time it takes to complete my task.	.89	5.237	1.361	
	GRAT9	I am satisfied in using ICT facilities for teaching, learning and research.	.83	5.467	1.239	

4.10.1 Configural and Metric Invariance Analyses of the TAG Model

First, without constraining the structural paths, the results derived a baseline Chi-square value. Next, the structural paths were constrained to be equal for the University of Malaya and Jiaxing University. The results for both constrained and unconstrained models were found to be consistent with the data as shown in Figure 4.11 and 4.12. The analysis of this constrained TAG model produced another Chi-square value (1768.175) and df = 746, which was then tested against the unconstrained Chi-square value (1738.118) and df = 738 for statistically significant differences.

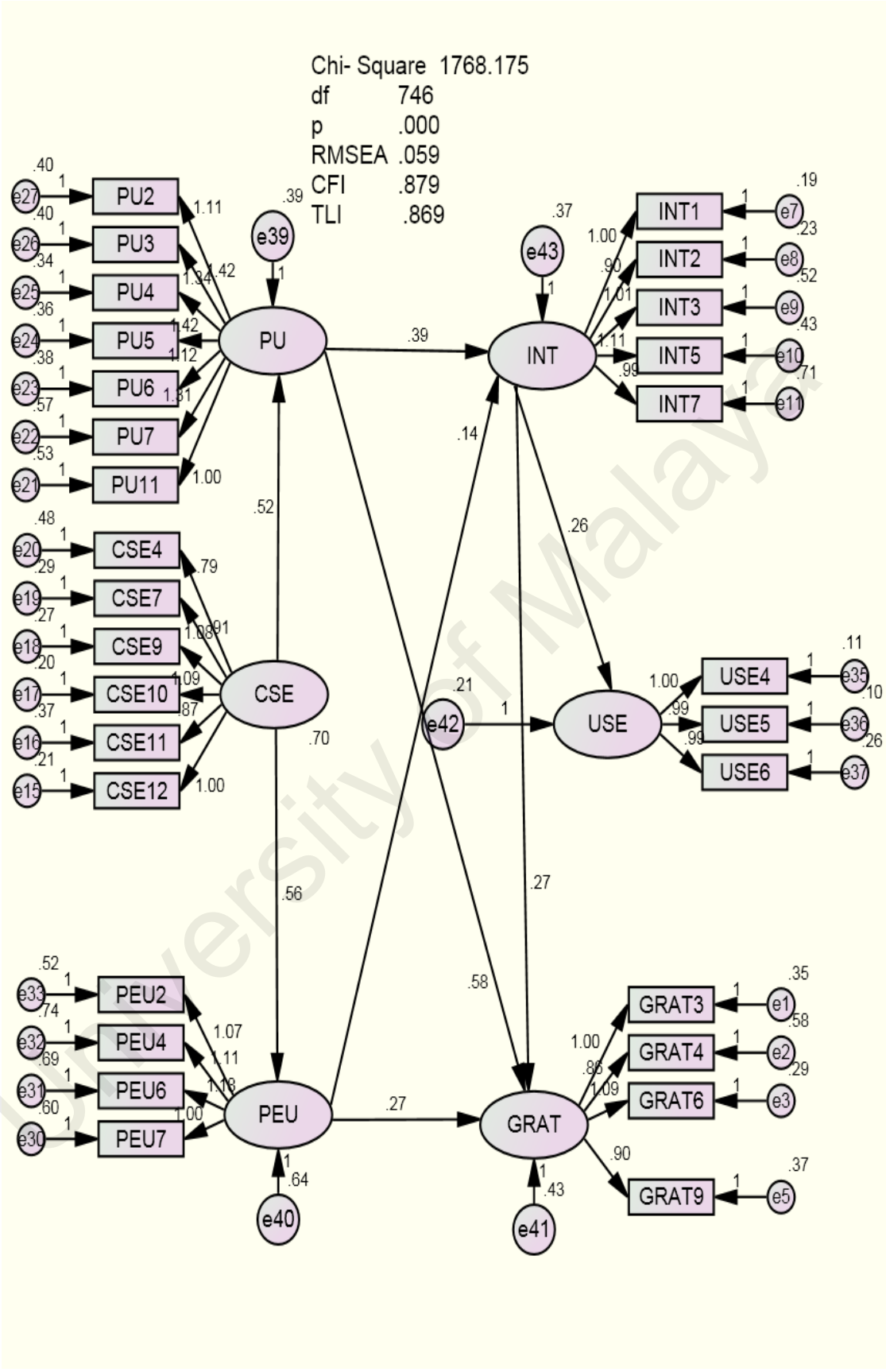

Figure 4.11: The Constrained TAG Model

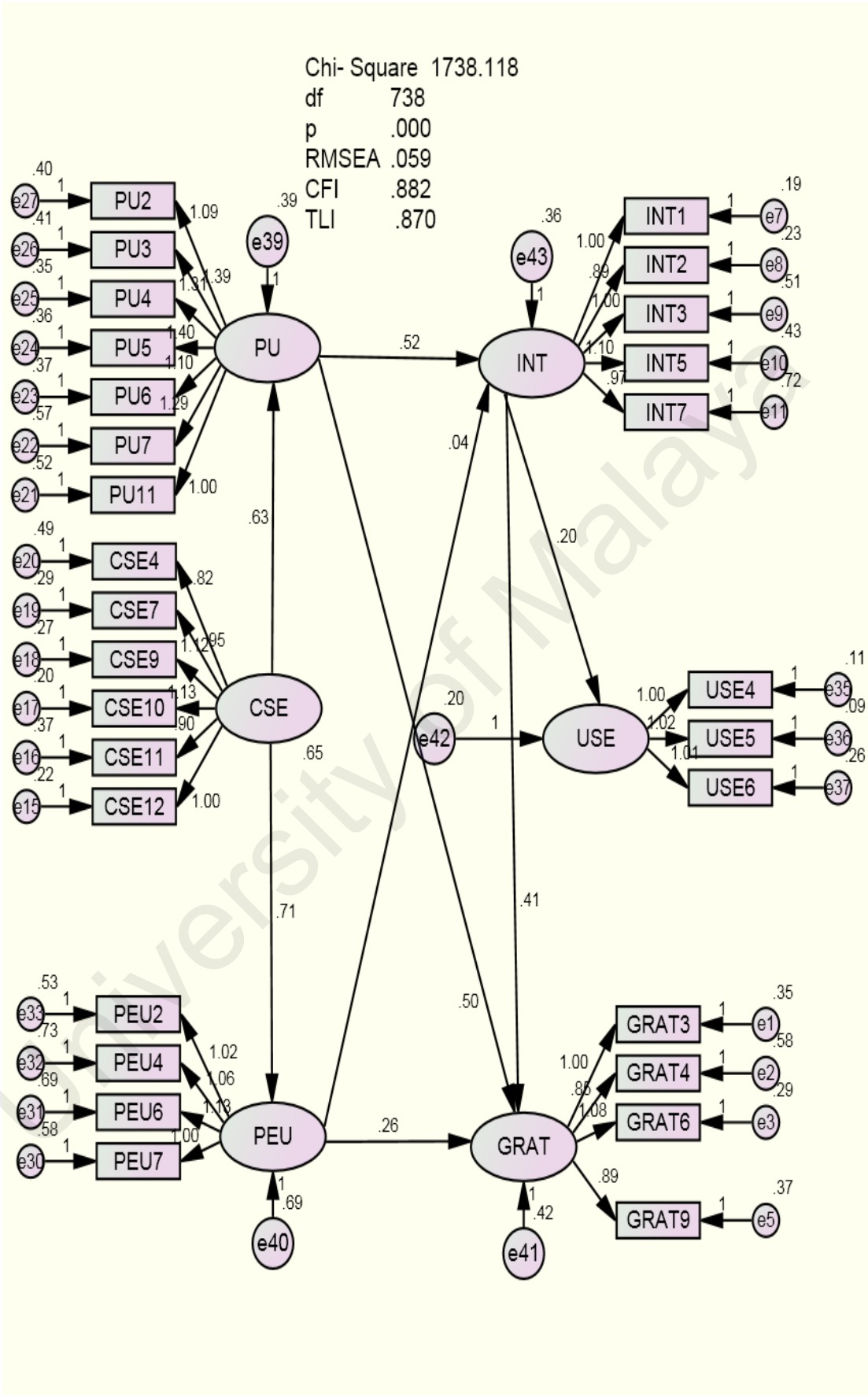

Figure 4.12: The Unconstrained TAG Model

The invariance test between the University of Malaya in Malaysia and Jiaxing University in China resulted in a statistically significant change in the Chi-square value, Chi-square (df = 8) = 30.057, $p > 0.05$, while the critical value was at 15.507 as shown in Table 4.24. This meant that cross-culture did interact with the exogenous variables to influence the lecturers' adoption and gratification in using ICT facilities in higher education in Malaysia and China. The results of the invariance analysis of the TAG model also demonstrated that the model was valid for measuring lecturers' adoption and gratification in using ICT facilities in the diverse context of higher education. It is, therefore, reasonable to conclude that cross-culture was a moderating variable, whereas the TAG model works differently in cross-cultural settings.

Table 4.24: Results of Critical Value of Chi-squared

Models		Chi squared	df	Critical value	Chi squared change
A Cross-cultural validation between University of Malaya (Malaysia) and Jiaxing University (China)	Unconstrained	1738.118	738	15.507 ($p > 0.05$)	30.057
	Constrained	1768.175	746		

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 INTRODUCTION

The main objective of the study was twofold. The first was to develop and validate the Technology Adoption and Gratification (TAG) Model to assess the lecturers' adoption and gratification in using ICT facilities for their teaching and research in higher education which was achieved through the specific objectives 2 to 7. The second purpose of the study was to evaluate the cross-cultural validation of the causal structure of the TAG model. To achieve these objectives two versatile statistical tools were applied. Firstly, the questionnaire's reliability and validity were established through a Rasch analysis. Secondly, the data were analysed using a three-step Structural Equation Modeling (SEM) involving Confirmatory Factor Analysis (CFA) to validate the measurement models, full-fledged structural model to estimate the hypothesized and revised models of the lecturers' adoption and gratification in using ICT facilities and invariance analysis (metric and configural invariance analyses) to examine the cross-cultural-invariant of the TAG model. The data were collected through a questionnaire, and was administered to 396 lecturers who were selected using stratified random sampling from two comprehensive public universities, namely, the University of Malaya in Malaysia and Jiaxing University in China. This chapter highlights the main findings of the study, discusses them in relation to theory and prior studies, and concludes with recommendations and limitations for future research.

5.2 DISCUSSION OF THE FINDINGS

The results have theoretically contributed to the existing body of knowledge and current understanding on the Technology Adoption and Gratification (TAG) model in numerous ways. The model was developed and validated by incorporating three models, namely, Technology Acceptance Model (Davis et al., 1989), Online Database Adoption and Satisfaction Model (Islam, 2011a) and Technology Satisfaction Model (Islam, 2014), to assess the lecturers' adoption and gratification in using ICT facilities for their teaching and research in higher education. The broad objective of this study was achieved through specific objectives. To address the specific objectives 2 and 3, the present study generated and tested three hypotheses (*H2*, *H3* and *H9*) as discussed below.

First, perceived ease of use had a statistically significant direct influence on lecturers' intention to use and gratification but not actual use, thereby validating the second hypothesis (*H2*); a finding also consistent with earlier studies which demonstrated the influential effect of perceived ease of use on users' intention to use computer-based systems (Chau, 1996; Karahanna & Straub, 1999; Venkatesh & Davis, 1996, 2000; Venkatesh & Morris, 2000). However, perceived ease of use was found to be less influential and reliable (Ma & Liu, 2004; Wu et al., 2008; Huang, 2008). Several researches prior to this also observed no significant relationship between the perceived ease of use and behavioral intention (Jackson, Chow, & Leitch, 1997; Hu et. al., 1999). In other studies, Tenopir (2003) found that ease of use was a major factor influencing her respondents' adoption of the online database. Outside the educational context, Lee et al., (2006) showed that perceived ease of use significantly enhanced consumer attitude and behavioral intention towards an online retailer, while Ramayah and Lo (2007) demonstrated a significant effect of perceived ease of use on intention

to use an electronic resource planning system. Along this line, Lee and Lehto (2013) and Islam (2011a) hypothesized that perceived ease of use will have a significant effect on intention to use. Nevertheless, the findings of their study indicated that perceived ease of use did not exert statistically significant effect on behavioral intention to use.

On the one hand, Hanafizadeh et al., (2014) found that bank clients' perceived ease of use had a significant influence on intention to use mobile banking, while Gultekin (2011) discovered that the effects of perceived ease of use on police officers' intention to use the POLNET system were also statistically significant. Subsequently, Stone and Baker-Eveleth (2013) confirmed that perceived ease of e-textbook use positively influences behavioral intentions to purchase an e-textbook, however, Martínez-Torres et al., (2008) discovered that perceived ease of use had a slightly weaker influence compared to perceived usefulness on behavioural intention to use e-learning tools. Many previous studies also demonstrated that perceived ease of use was an antecedent factor that affected intention to accept English mobile learning (Chang et al., 2012) as well as computer based assessment in higher education (Terzis et al., 2013). Even though, Shroff et al., (2011) confirmed that students' perceived ease of use had significant influence on perceived usefulness and attitude towards usage of portfolio system.

On the other hand, the present study inferred the possible relationship between these two variables from several studies that investigated the relationship between perceived ease of use and satisfaction (Lee & Park, 2008; Islam, 2014; Islam, 2011a; Islam, 2011b; Huang, 2008; Shamdasani et al., 2008). The results of Szymanski and Hise (2000) and Dabholkar and Bagozzi (2002) found convenience (a construct very similar in concept to ease of use) to be an important factor in e-satisfaction.

Furthermore, Devaraj et al., (2002) exhibited that perceived ease of use was revealed to be a significant determinant of satisfaction in the transaction cost analysis as well as an important component of TAM in forming consumer attitude and satisfaction with the electronic commerce channel, while Islam et al., (2015) confirmed that perceived ease of use had a significant effect on students' satisfaction in using online research database in higher education. Thus, this study concluded that lecturers are more likely to adopt ICT facilities for its ease of use coupled with their gratification in using it, rather than its actual use.

Second, the results of the revised TAG model confirmed the significant direct influence of perceived usefulness on lecturers' intention to use and gratification but not actual use of ICT facilities, hence validating the third hypothesis (*H3)*. This was congruent with the findings of prior studies (Wu *et al.,* 2008; Davis, 1989; Guriting & Ndubisi, 2006; 2004; Ramayah et al., 2005; Ramayah & Lo, 2007; Venkatesh, 2000; Agarwal *et al.,* 2003; Davis, 1993; Mathwick *et al.,* 2001; Ahmad *et al.,* 2010), which found the significant influence of perceived usefulness on technology adoption. Similarly, the impact of perceived usefulness on users' intention to use different types of computer-based and Internet-based systems has been comprehensively documented in numerous studies (Ahmad et al., 2010; Davis, 1993; Guriting & Ndubisi, 2006; Mathwick et al., 2001; Ramayah & Lo, 2007). Wu et al., (2008) corroborated these findings on the impact of perceived usefulness by noting that it is a significant determinant of science teachers' intention to assimilate technology into their instruction. Recent studies have also explored a significant effect of perceived usefulness on users' intention to use mobile learning (Hanafizadeh et al., 2014; Chang et al., 2012), the POLNET system (Gultekin, 2011), e-learning tools (Martínez-Torres et al., 2008) and e-portfolio systems (Shroff et al., 2011). In line with this, Terzis et al.,

(2013) showed that perceived usefulness demonstrated a significant influence on students' intention to use computer based assessment in higher education. According to Davis et al., (1989) perceived usefulness was an important predictor, which strongly influenced users' intentions, while TAM (Davis, 1993) showed that perceived usefulness had a significant direct effect on the actual use of information technology.

Additionally, the TSM (Islam, 2014) discovered that perceived usefulness had a significant positive direct effect on students' satisfaction in using wireless internet in higher education. Concerning the Online Database Adoption and Satisfaction (ODAS) Model, Islam, (2011a) confirmed that, perceived usefulness had a statistically significant indirect influence on postgraduate students' satisfaction mediated by intention to use online research databases, while Islam et al., (2015) exhibited that perceived usefulness was the most important construct of TSM in affecting postgraduate students' satisfaction in using online research databases in higher education. Subsequently, Lee and Park (2008) indicated that perceived usefulness had a significant effect on user satisfaction. Meanwhile, Islam (2011b) found that perceived usefulness moderately influenced students' satisfaction in using wireless technology. However, its impact on satisfaction might be reflected through the significant interrelationships with other latent constructs, namely, perceived ease of use and computer self-efficacy. In addition to this, in extant literature, numerous studies exist vis-à-vis the effect of perceived usefulness on consumer satisfaction (Anderson et al., 1994). According to Huang (2008), perceived usefulness was found to have an impact on consumer satisfaction mediated by their behavioral attitudes. On the other hand, Clemons and Woodruff (1992) reported that, perceived value might directly lead to the formation of overall feelings of satisfaction. This argument is corroborated by McDougall and Levesque (2000) who indicated that, perceived value

is a significant driver of customer satisfaction, while Devaraj et al., (2002) revealed that perceived usefulness was an important dimension in forming consumer attitude and satisfaction with the electronic commerce channel. The discovery was that when lecturers understand the benefits of ICT facilities, they are more likely to use the service provided by the universities because they believe ICT facilities can enhance their research and teaching ability and performance. Moreover, the data exhibited that perceived usefulness was one of the important factors of the TAG model in affecting lecturers' adoption and gratification in using ICT facilities in higher education.

Third, the results of the TAG model depicted that perceived ease of use and perceived usefulness had positive indirect influences on lecturers' gratification in using ICT facilities mediated by intention to use separately validated the ninth hypothesis (*H9*). This concurred with an earlier study (Islam, 2011a), which found perceived usefulness indirectly influenced students' satisfaction in using online research databases mediated by intention to use, while perceived ease of use had a direct effect on satisfaction. However, in their study, Shamdasani et al., (2008) observed that ease of use mediated by service quality, did not have a big influence on satisfaction. In recent studies, perceived usefulness and perceived ease of use showed a significant direct effect on students' satisfaction in using wireless internet (Islam, 2014) and online research databases in higher education (Islam et al., 2015). Therefore, it was found that when lecturers understand the ease of use and benefits of ICT facilities, they are more likely to use the service provided by the universities because they believe ICT facilities can increase their research and teaching performance.

To address the specific objective 4, this study generated and tested four hypotheses (*H1*, *H6*, *H7* and *H8*) as discussed below.

Firstly, the hypothesis (*H1*) that computer self-efficacy would exert a positive direct influence on lecturers' perceived ease of use and perceived usefulness of the ICT facilities in higher education stands validated as the findings were congruent with prior studies which discovered the significant influence of computer self-efficacy on perceived usefulness and perceived ease of use, respectively (Islam, 2014; Islam et al., 2015). Moreover, the results also revealed that computer self-efficacy was the most significant construct of the TAG model in directly affecting lecturers' perceived usefulness and perceived ease of use of the ICT facilities, while the technology satisfaction model (TSM) confirmed that computer self-efficacy was the most influential factor in measuring students' satisfaction in using wireless internet (Islam, 2014) and the online research databases (Islam et al., 2015) in higher education. Previous studies confirm propositions that self-efficacy influences the choice as to whether or not one engages in a task, the effort made in performing it, and the level of persistence required in accomplishing it (Bandura, 1977; Bandura & Schunk, 1981; Delcourt & Kinzie, 1993). It influences how people feel, think, and behave (Bandura, 1986: 393). According to Ahmad et al., (2010), the inclusion of self-efficacy as an intrinsic motivation construct offers 'deeper and richer understanding of why and how the technology is used'. However, they discovered that computer self-efficacy indirectly influences faculty's use of computer mediated technology through perceived usefulness and intention to use. Islam (2011a & 2011b) demonstrated the significant interrelationships among the exogenous variables which were measured in the revised structural model, and it was found that the interrelationships between computer self-efficacy, perceived ease of use and perceived usefulness were

statistically significant. YouTube users' self-efficacy indicated a significant effect on perceived usefulness (Lee & Lehto, 2013), whereas Stone and Baker-Eveleth (2013) hypothesized that a mid-sized university students' self-efficacy regarding the use of an e-textbook significantly influences outcome expectancy/usefulness regarding e-textbooks but it did not exert statistically significant effect on outcome expectancy/usefulness in purchasing electronic textbooks. In a related study, Tezci (2011) asserted that pre-service teachers' self-efficacy levels regarding ICT usage in education were found to be moderate. Thus, teachers' self-efficacy or self-confidence concerning ICT usage must be high in order for them to be highly encouraged in the use of ICT, which in turn would lead to flourishing ICT integration. Amin (2007) confirmed that university students' computer self-efficacy of internet banking had a significant effect on their perceived usefulness and perceived ease of use. Similarly, Wong et al., (2012) revealed that computer teaching efficacy had a significant effect on perceived usefulness, perceived ease of use and attitude towards computer use. Nevertheless, the findings of their studies showed that computer teaching efficacy only moderately effects perceived usefulness when compared to other constructs. According to Zejno and Islam (2012), computer self-efficacy is one of the significant predictors of postgraduate students' ICT usage in higher education.

On the other hand, Terzis et al., (2013) explored that Greek and Mexican university students' computer self-efficacy had a positive influence on their perceived ease of use, which shows that if a student knows how to use computers, perhaps he/she will find it easy to use a computer based assessment that needs fundamental information technology skills. In a study involving university students' use of an information system, Agarwal and Karahanna (2000) discovered that computer self-efficacy was a key antecedent of perceived ease of use, while Wu et al., (2008) found

a statistically significant relationship between teachers' CSE and their intention to use ICT in teaching. More importantly, the present study discovered that lecturers' adoption and gratification of ICT facilities does not depend only on perceived ease of use and perceived usefulness, but also on their beliefs in their own ability to use it. Thus, computer self-efficacy is acknowledged as a distinct antecedent of perceived usefulness and perceived ease of use, which is an important intrinsic motivation factor of technology adoption and gratification.

Secondly, the findings of the TAG model discovered that computer self-efficacy had a significant indirect effect on lecturers' intention to use of ICT facilities mediated by perceived ease of use and perceived usefulness separately, thereby validating the sixth hypothesis (*H6*). However, Ahmad et al., (2010) found that computer self-efficacy indirectly influences faculty's use of computer mediated technology through perceived usefulness and intention to use. Prior studies also demonstrated the influential effect of computer self-efficacy on technology adoption and usage (Wu *et al.,* 2008; Gong et al., 2004; Hu et al., 2003; Agarwal & Karahanna, 2000; Compeau et al., 1999; Ahmad *et al.,* 2010; Compeau & Higgins, 1995; Dabholkar & Bogazzi, 2002; Ellen et al., 1991). Stone and Baker-Eveleth (2013) showed that computer self-efficacy positively influenced students' attitudes regarding the purchase of e-textbooks. Alenezi et al., (2010) confirmed that computer self-efficacy significantly influenced students' intention to use e-learning. According to Chang and Tung (2008), self-efficacy was an important factor for university students' behavioural intention to use the online learning course websites, while Zejno and Islam (2012) claimed that computer self-efficacy is one of the significant predictors of postgraduate students' ICT usage. In a recent study, Islam (2011a) demonstrated that computer self-efficacy had a direct influence on postgraduate students' intention to

use online research databases. In fact, the influence of this construct is evident in many cases involving the employment of computer technology (Ball & Levy, 2008; Charalambous & Papaioannou, 2010; Kenzie et al., 1994; Moos & Azevedo, 2009). More importantly, the present study discovered that lecturers' adoption and gratification of ICT usage does not only depend on perceived ease of use and perceived usefulness, but also on their beliefs in their own ability to use it. Thus, computer self-efficacy is acknowledged as a distinct antecedent of intention to use, which is an important intrinsic motivation factor of technology adoption and gratification. As such, computer self-efficacy can indirectly influence lecturers' intention to use ICT facilities in higher education.

Thirdly, the results of the TAG model demonstrated that computer self-efficacy had a statistically significant indirect influence on lecturers' gratification in using ICT facilities mediated by perceived usefulness and perceived ease of use separately, which validated the seventh hypothesis (*H7*). The results were consistent with prior studies (Islam, 2014; Islam et al., 2015) which exhibited that computer self-efficacy was the most dominant factor of the TSM and it also had an indirect significant influence on satisfaction mediated by perceived ease of use and perceived usefulness, respectively. The ODAS model (Islam, 2011a) revealed the significant interrelationships among the exogenous variables, namely, computer self-efficacy, perceived ease of use and perceived usefulness in measuring postgraduate students' adoption and satisfaction in using online research databases. Similarly, Islam (2011b) also found significant positive interrelationships among the three exogenous variables, namely, computer self-efficacy, perceived ease of use and perceived usefulness in assessing students' satisfaction in using wireless internet in higher education. However, computer self-efficacy had a significant indirect effect on students'

satisfaction mediated by intention to use (Islam, 2011a, p. 50). Thus, the findings suggested that lecturers the ICT usage for its self-efficacy because of their beliefs in their computer ability.

Finally, in regards to the indirect effect of computer self-efficacy on lecturers' use of ICT facilities mediated by perceived ease of use and perceived usefulness separately, the findings had an insignificant path co-efficient, thereby invalidating the eighth hypothesis (*H8*). However, several studies explored the direct relationships between computer self-efficacy, perceived ease of use as well as perceived usefulness (Islam, 2014; Islam et al., 2015). As a result, this hypothesis was dropped in the revised model.

To address the specific objective 5, the present study generated and tested two hypotheses (*H4* and *H10*) as discussed below.

First, as revealed by the significant direct path coefficient, intention to use significantly influenced lecturers' gratification and actual use of ICT facilities in higher education, thereby validating the fourth hypothesis (*H4*). This finding corroborated the results of the ODAS model (Islam, 2011a), which demonstrated that intention to use had a positive direct effect on students' satisfaction in using online research databases in higher education. This study had inferred the possible relationship between intention to use and gratification from several studies investigating the relationship between computer self-efficacy and intention to use (Wu et al., 2008; Ahmad et al., 2010) and intention to use with individual satisfaction (Huang, 2008; Shamdasani et al., 2008). On the other hand, Davis et al., (1989) hypothesized and confirmed that behavioral intention was the key determinant of actual use of computer technology. Their findings also stated that behavior should be

predictable from measures of users' behavioral intention and that if there were any additional constructs that effected user behavior, they do so indirectly by influencing behavioral intention. However, Davis (1993) ignored the behavioral intention, which was the most important factor of the TAM, whereas attitude toward using revealed a significant direct effect on actual system use of information technology. Furthermore, the data for this study explored that lecturers' behavioral intention to use was one of the dominant factors in affecting their adoption and gratification in using ICT facilities in teaching and research.

Second, the indirect influence of intention to use on lecturers' gratification mediated by actual use of ICT facilities in higher education was found to be a statistically insignificant path coefficient, thereby invalidating the tenth hypothesis (*H10*). However, Islam (2011a) investigated the direct relationship between intention to use and satisfaction and intention to use with individual satisfaction (Huang, 2008; Shamdasani et al., 2008). In addition, the findings of the TAG model also confirmed that lecturers' intention to use of ICT facilities was one of the vital factors in evaluating technology adoption and gratification in higher education.

To address the specific objective 6, this study generated and tested one hypothesis (*H5*) as discussed below.

In regards to the effect of actual use on lecturers' gratification in using ICT facilities, it had an insignificant path co-efficient, thereby invalidating the fifth hypothesis (*H5*). However, user satisfaction was found to be positively related to perceived market performance (Lee & Park, 2008). According to Shipps and Phillips (2013), attitude toward the social networking tool showed a significant effect on user satisfaction, while Devaraj et al., (2002) indicated general support for consumer

satisfaction as a determinant of channel preference. Thus, the finding of this study suggested that lecturers adopted and gratified the ICT facilities not only for its actual usage, but rather for its ease of use, usefulness, intention to use and because of their beliefs in their computer self-efficacy.

To address the specific objective 7, it was not necessary to generate a hypothesis, as the endogenous variable was assessed applying Confirmatory Factor Analyses (CFA) as well as Structural Equation Modeling (SEM) like other objectives. For instance, the objectives 2 to 7 were firstly evaluated using CFA to confirm lecturers' perceptions in using ICT facilities for their teaching and research purposes in higher education in terms of perceived ease of use, perceived usefulness, computer self-efficacy, intention to use, actual use and gratification. Later on, to examine the causal relationships and the effect of perceived ease of use, perceived usefulness, computer self-efficacy, intention to use and actual use on gratification, the present study tested nine hypotheses as discussed above. However, lecturers' gratification did not have any influence on other latent constructs, so the hypothesis was not required to test for this objective. Besides this, the results of the one-factor measurement model of gratification were analyzed using CFA and confirmed that lecturers' views on the gratification in using ICT facilities. The one-factor measurement model of gratification explained almost 64.1% of the variability of lecturers' gratification in using ICT facilities for their teaching and research purposes in higher education.

To address the specific objective 8, the present study generated and tested one hypothesis (*H8*) as discussed below.

This study exhibited that there was a cross-cultural invariant of the causal structure of the TAG model, thereby validating the eighth hypothesis (*H8*). This

meant that cross-culture did interact with the exogenous and mediating variables to influence lecturers' adoption and gratification in using ICT facilities in higher education in both Malaysia and China. The findings of this study confirmed that there were significant differences between Malaysian and Chinese lecturers in using ICT facilities for their teaching and research purposes in higher education. This was consistent with a prior study (Teo et al., 2008), which found that there were significant dissimilarities between Malaysian and Singaporean pre-service teachers in terms of their computer attitude, perceived ease of use and perceived usefulness of technology. Chong et al., (2012) explored that consumers' intention to adopt mobile commerce was affected by the different cultures, namely, Malaysian and Chinese. On the other hand, Terzis et al., (2013) discovered that the Computer Based Assessment Acceptance Model (CBAAM) was valid for both countries (Greece & Mexico) in general; however, there were some distinctions due to the culture. Moreover, Singh et al., (2006) showed that the causal relationships between the extended TAM factors, namely, perceived ease of use, perceived usefulness, cultural adaptation, attitude and behavioral intention to use international websites presented strong evidence for the viability of TAM in elucidating website usage in Brazil, Germany, and Taiwan. Along this line, Al-Gahtani et al., (2007) examined the similarities and dissimilarities between Saudi Arabian and North American validations of UTAUT with regards to cultural diversities that influenced the users' acceptance of IT in these two societies. Similarly, Keil and Brenner (1997) demonstrated that TAM was influenced by the three different cultures in the United States, Japan, and Switzerland. According to Huang et al., (2003), the validity of TAM was expanded by assessing technology acceptance beliefs in a developing country with Chinese culture.

5.3 CONCLUSION

As information technology is increasingly used in education, its integration in teaching, learning and research has had an immense significance in fostering technology-based education among the lecturers of universities. The findings contributed to a better understanding of the Technology Adoption and Gratification (TAG) model, which was developed and validated for assessing lecturers' adoption and gratification in using ICT facilities for their teaching and research purposes in higher education among the two comprehensive public universities, namely, the University of Malaya in Malaysia and Jiaxing University in China. To develop and validate the TAG model, data were gained through a survey questionnaire. The psychometric properties of the TAG models' reliability and validity were performed by a Rasch model using Winsteps version 3.49. The advantage of using a Rasch model was that it measured not only items' reliability and validity but also persons' reliability and validity, while most of the studies focused only on the items' reliability and validity. This study discovered that the TAG model was integrated by six valid measurement models of the latent constructs, namely, computer self-efficacy (CSE), perceived usefulness (PU), perceived ease of use (PEU), intention to use (INT), actual use (USE) and gratification (GRAT) as tested individually by the Confirmatory Factor Analysis (CFA) to obtain specific objectives. To test all the hypotheses, the structural equation modeling (SEM) was applied to develop and validate the TAG model as well as its causal relationships among the constructs. The findings of the TAG model revealed that lecturers' computer self-efficacy had a statistically significant direct influence on perceived ease of use and usefulness of ICT facilities in higher education for their teaching and research. On the other hand, lecturers' perceived ease of use and perceived usefulness had a significant direct influence on their gratification in using

ICT facilities in higher education. Subsequently, perceived usefulness and perceived ease of use were found to have a significant direct influence on lecturers' intention to use ICT facilities for their teaching and research. Similarly, lecturers' intention to use had a statistically significant direct effect on their gratification as well as actual use of ICT facilities. Moreover, computer self-efficacy had a significant indirect influence on gratification mediated by perceived ease of use and perceived usefulness, respectively. Meanwhile, computer self-efficacy had also a significant indirect influence on lecturers' intention to use mediated by perceived ease of use and perceived usefulness, respectively. Lastly, lecturers' perceived ease of use and perceived usefulness had a significant indirect effect on their gratification in using ICT facilities in higher education mediated by intention to use. The data also exhibited that computer self-efficacy moderately more influential factor in the revised TAG model in directly affecting the lecturers' perceived usefulness and perceived ease of use as well as indirectly influencing the lecturers' intention to use and gratification in using ICT facilities in higher education for their research and teaching purposes. In addition, the analysis demonstrated that the exogenous variable (CSE) explained almost 28% and 29% of the variance in perceived ease of use and perceived usefulness respectively, while the exogenous variable (CSE) and the two mediator variables (PU and PEU) collectively explained approximately 25% of the variability of lecturers' intention to use of ICT facilities in higher education. Similarly, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) explained almost 20% of the variance of lecturers' actual use of ICT facilities. This implies that lecturers' use of ICT facilities are found to be underutilized. Finally, the exogenous variable (CSE) and the three mediator variables (PU, PEU and INT) collectively explained approximately 56% of the variability of lecturers' gratification in using ICT facilities in higher

education. The revised TSM model exhibited adequate convergent and discriminant validity, with all loadings indicating a value greater than 0.70 as shown in Figure 4.15.

Several findings of the TAG model were consistent with the Technology Satisfaction Model (TSM), Technology Acceptance Model (TAM) and Online Database Adoption and Satisfaction (ODAS) model and contributed that the TAG is able to evaluate lecturers' adoption and gratification in using ICT facilities in teaching and research. However, TSM focused only on students' satisfaction in using wireless internet (Islam, 2014) and online research databases (Islam et al., 2015) in higher education but ignored its adoption. Similarly, TAM, developed by Davis (1989), ignored the issues of computer self-efficacy and satisfaction. In general, TAM is used for measuring the acceptance of technology (Islam, 2014). On the other hand, Islam (2011a) developed and validated the ODAS model by incorporating two intrinsic motivation attributes, namely, computer self-efficacy and satisfaction into the original TAM. However, the ODAS model overlooked an extrinsic motivation component, namely, actual use which is an important factor for assessing technology acceptance or adoption as suggested by prior studies. As such, this study combined TSM, TAM and the ODAS model to develop and validate the TAG model which would be able to examine any kind of technology adoption and gratification simultaneously.

The findings brought forth some noteworthy information about lecturers' adoption and gratification of the universities' ICT facilities. First, they used the ICT facilities largely because they found it beneficial and easy to use for their teaching and research purposes. Moreover, they also had strong self-efficacy in using ICT facilities in higher education. The ability (computer self-efficacy) appeared to be a stronger factor than perceived usefulness and perceived ease of use in influencing their adoption and gratification of ICT. As the universities provide a library information on

the use of ICT facilities, lecturers' lack of ICT skills and efficacy is most likely not a real threat to its adoption and gratification. Lecturers will persist in the use of ICT facilities if the benefits are much greater than the difficulties encountered. To increase the usefulness of ICT facilities, the university authorities should reexamine the utility of resources because teaching, learning and research are facilitated only if lecturers have access to the facilities.

Second, ease of use is a determinant for lecturers' gratification, intention to use and actual use of ICT, which directly and indirectly influences their adoption and gratification in using it. In other words, the university authorities can increase lecturers' gratification by enhancing the user-friendliness of their ICT facilities in terms of the user interface, hyperlinks and search facilities. Gratification may also be directly influenced by the users' ability to retrieve desired information from electronic resources. To address difficulties in retrieving information, authorities should focus their training on database-specific search skills, rather than just increasing the awareness of their existence and utilities. In fact, the ability to retrieve information from different databases could be a stronger predictor of adoption and gratification, compared to computer self-efficacy because a discrepancy usually exists between users' beliefs in their ability to retrieve information from electronic systems and their actual ability to do it.

Evidenced from the revised TAG model showed that the direct and indirect effect of lecturers' computer self-efficacy on perceived ease of use, perceived usefulness, intention to use and gratification in using ICT facilities was limited to their requisite skills to communicate electronically with colleagues and students, use ICT facilities to enhance the effectiveness of teaching, learning and research, improve the quality of research works in using ICT facilities, navigate their way through ICT

facilities, save and print journals or articles from the research databases. In addition, they also had the knowledge and skills to benefit from using the university ICT facilities. However, Islam (2011a & 2014) discovered that postgraduate students articulated obstacles related to accessing journals from the online research databases.

The influence of lecturers' perceived usefulness on intention to use, gratification and actual use of ICT facilities in teaching and research manifested in lecturers increasing research productivity, making work more interesting, improving the quality of the work they do, enhancing research skills, making information easier to find, making information readily available, and providing the latest information on specific areas of research. Notwithstanding, Islam (2011a) revealed that postgraduate students articulated their limitations on retrieving current information on a particular area of research and enhancing their knowledge and research skills in using the online research databases. In a related study, Islam (2014) found that students expressed their constraints vis-à-vis slow wireless internet speeds compared to the LAN as well as difficulty in getting wireless internet access from anywhere and anytime in the campus. Moreover, the convenience of access, in particular, has been frequently cited as a major advantage by users of electronic journals in multiple studies (Maughan, 1999; Tenner & Yang, 1999; Hiller, 2002). In Liew et al., (2000), the benefits of electronic resources were found to be the facility to link to additional information, the ability to browse, and the currency of materials. Other benefits and advantages included robust search capabilities, hyperlinks to outside content, efficient acquisition of information (Dillon & Hahn, 2002; Ray & Day, 1998), time saving factors, and print and save capabilities (Togia & Tsigilis, 2009). These benefits and advantages were realized all the more by students when their learning and academic pursuits became greatly enhanced.

The influence of lecturers' perceived ease of use on intention to use, actual use and gratification in using ICT facilities was exhibited in terms of their easy access to the university research databases, the minimal effort required in interacting with the research databases system, and it being a stimulating interaction. It was also evident that lecturers found it easy to select articles/journals of different categories using university research databases. However, Islam (2011a) demonstrated that some barriers still persisted. These were manifested by the postgraduate students' inadequacy in choosing articles or journals from the online research databases, requiring a lot of mental effort to download research materials, and the difficulty in searching for research materials from the online research databases. In addition, it was not easy to become skillful in using online research databases according to the students. Subsequently, the findings of the TSM (Islam, 2014) indicated that students showed that some obstacles still lingered; these were noticeable in the inadequate speed experienced by the students in downloading the materials from the wireless internet. Moreover, it was not easy to connect and register for wireless facilities as perceived by the students.

The significant effect of intention to use on actual use and gratification in using ICT facilities was captured in terms of their intention to carry out research activities, use computer applications to present lecture materials in class, use Microsoft office applications to write research papers, use ICT facilities for teaching, learning and research purposes frequently, and use the university research databases to update themselves on the research areas they are pursuing. Nonetheless, prior study indicated that postgraduate students' intention to use online research databases was limited to their wiliness to carry out research activities and write theses and journals (Islam, 2011a). Thus, the results of TAG model confirmed lecturers' adoption and

overall gratification in using ICT facilities for their teaching, learning and research purposes in higher education. However, the actual use was found to be underutilized, especially by the lecturers of the University of Malaya in Malaysia and Jiaxing University in China.

Additionally, the findings of this study also revealed that the TAG model was able to measure lecturers' adoption and gratification in using ICT facilities at two comprehensive public universities in Malaysia and China. However, the TAG model works differently in cross-cultural settings. This meant that cross-culture did interact with the exogenous and mediating variables to influence the lecturers' adoption and gratification in using ICT facilities in higher education. It is, therefore, reasonable to conclude that cross-culture was a moderating variable for the TAG model. This is a research area worth looking into by the university authorities, researchers, academicians and administrations in higher education.

Finally, the findings have several important implications for ICT providers in universities worldwide. The rapid uptake of the technology has made ICT facilities indispensable tools for research, teaching and learning, and considering their paramount importance in the contemporary context of university education, it would do the providers and universities well to address issues of ICT usefulness, ease of use, efficacy, use and gratification. The benefits gained from ICT use would certainly increase lecturers' gratification, therefore resulting in their continued adoption of the facility. The present study applies systematic research approaches of model development and validation by using a Rasch model and a structural equation modeling so that researchers from other countries might benefit from applying these techniques in their future studies. Researchers could also benefit from this study by knowing the constructs of the TAG model, namely, computer self-efficacy, perceived

usefulness, perceived ease of use, intention to use, actual use and gratification of ICT facilities, which could be applied to their further studies. The findings of this study confirmed the cross-cultural validation of the TAG model in assessing technology adoption and gratification in higher education, whereas existing models such as TAM and Diffusion and Innovation theory are only allowing researchers to measure either technology acceptance or adoption. As a result, the TAG model could be a unique contribution to researchers from other countries.

Albeit the research methodology appears valid, reliable and eliciting, only two higher educational institutions with a small sample size are used. It is therefore, the research may lack in a variation of respondents. A wider research using more organizations with more samples may help to validate the (TAG) model with a greater acceptability. Critics may generate the questions on its validity showing less number of samples as the excuse. However, the usage of ICT and its users hold a global pattern; thus, this model has a great potential to work globally regardless of geographical, economical, social and cultural patterns in a particular country or region. Further research in this area should examine the true utility of all the services provided in a university before money is invested in their purchase and installation. Furthermore, future research could investigate additional constructs, namely, teaching effectiveness, and knowledge and skill acquisition in the classroom to included into the TAG model which may foster a better understanding of it. Additional studies could also be done upon this study by applying the TAG model in cross-cultures to measure new areas in detail such as digital library services, online education, online shopping, mobile learning, social networks, and any other innovative technological services.

However, further research on cross-validation of the TAG model could be done to explain the moderating effects of various demographic attributes on lecturers' or students' adoption and gratification. The gender, faculties, and nationalities of the teachers and students might be explored in this regard.

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